NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE COST EFFECTIVENESS OF WEST COAST DISTRIBUTED SIMULATION TRAINING FOR THE PACIFIC FLEET

by

Blane T. Shearon

December 2001

Thesis Advisor:	Joseph G. San Miguel
Associate Advisor:	William Hatch II

Approved for public release; distribution is unlimited

Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
19 Dec 2001	N/A	-

Title and Subtitle The Cost Effectiveness of West Coast Distributed Simulation Training for the Pacific Fleet	**Contract Number**
	Grant Number
	Program Element Number
Author(s) Shearon, Blane	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Naval Postgraduate School Monterey, California	**Performing Organization Report Number**
Sponsoring/Monitoring Agency Name(s) and Address(es)	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited	
Supplementary Notes The original document contains color images.	
Abstract	
Subject Terms	
Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UU
Number of Pages 199	

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE	*Form Approved OMB No. 0704-0188*

1. AGENCY USE ONLY ***(Leave blank)***	**2. REPORT DATE** December 2001	**3. REPORT TYPE AND DATES COVERED** Master's Thesis

4. TITLE AND SUBTITLE: The Cost Effectiveness of Distributed Simulation Training for Third Fleet	**5. FUNDING NUMBERS** **N/A**
6. AUTHOR(S) Shearon, Blane T.	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) **N/A**	**10. SPONSORING / MONITORING AGENCY REPORT NUMBER** **N/A**

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited	**12b. DISTRIBUTION CODE**

ABSTRACT ***(maximum 200 words)*** Emerging technologies are changing the way the Navy trains its people. The Director of Naval Training (N7) has stated that the Navy needs to incorporate this new technology into training plans. Furthermore, Navy leadership must evaluate different technologies such as multiple ship simulated combat systems training to determine which training methods provide the best value while maintaining high training and readiness standards. This thesis examined whether simulated in port training is a suitable supplement to underway training exercises. The conclusion was that the West Coast Distributed Simulation Network (WCDSN) was an effective Battle Group training tool. Two research approaches were used to arrive at this conclusion. First, post simulated exercise survey results indicate multi-ship training exercises provide valuable training prior to underway fleet exercises. Data from these surveys provide insight into the quality of training received through multi-ship simulated training and suggests courses of action that may improve current training. Next, an evaluation of the estimated cost and savings from simulated in port training was performed. In 2001, six Middle East Force, Amphibious Ready Group, and Battle Groups used the WCDSN to train, prior to underway exercises. The variable, recurring and fixed infrastructure costs incurred while using the network were compared to the fuel, utility, and manpower costs and the range savings realized by reduced underway training. Research findings indicate that an estimated net savings of approximately $9 million was achieved by conducting these six exercises in 2001. The greatest benefits of training using the WCDSN are the manpower benefits realized by keeping sailors in port and the net fuel savings from decreases in underway training.

14. SUBJECT TERMS Cost Effectiveness, Simulation, Training, Third Fleet, CINCPACFLT, BFTT, TACDEW, Combat Systems, Manpower, Fuel, FCTCPAC	**15. NUMBER OF PAGES** 198
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	**18. SECURITY CLASSIFICATION OF THIS PAGE**	**19. SECURITY CLASSIFICATION OF ABSTRACT**	**20. LIMITATION OF ABSTRACT**
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution unlimited

THE COST EFFECTIVENESS OF WEST COAST DISTRIBUTED SIMULATION TRAINING FOR PACIFIC FLEET

Blane T. Shearon
Lieutenant, United States Navy
B.A., University of Notre Dame Du Loc, 1994

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 2001

Author: **Blane T. Shearon**

Approved by: Joseph G. San Miguel, Thesis Advisor

William D. Hatch II, CDR, USN

William Hatch II, Associate Advisor

Kenneth J. **Euske,**
Dean
Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

Emerging technologies are changing the way the Navy trains its people. The Director of Naval Training (N7) has stated that the Navy needs to incorporate this new technology into training plans. Furthermore, Navy leadership must evaluate different technologies such as multiple ship simulated combat systems training to determine which training methods provide the best value while maintaining high training and readiness standards. This thesis examined whether simulated in port training is a suitable supplement to underway training exercises. The conclusion was that the West Coast Distributed Simulation Network (WCDSN) was an effective Battle Group training tool. Two research approaches were used to arrive at this conclusion. First, post simulated exercise survey results indicate multi-ship training exercises provide valuable training prior to underway fleet exercises. Data from these surveys provide insight into the quality of training received through multi-ship simulated training and suggests courses of action that may improve current training. Next, an evaluation of the estimated cost and savings from simulated in port training was performed. In 2001, six Middle East Force, Amphibious Ready Group, and Battle Groups used the WCDSN to train, prior to underway exercises. The variable, recurring and fixed infrastructure costs incurred while using the network were compared to the fuel, utility, and manpower costs and the range savings realized by reduced underway training. Research findings indicate that an estimated net savings of approximately $9 million was achieved by conducting these six exercises in 2001. The greatest benefits of training using the WCDSN are the manpower benefits realized by keeping sailors in port and the net fuel savings from decreases in underway training.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TERMS

ARGCERT	Amphibious Ready Group Certification
BEWT	BFTT Electronic Warfare Trainer
BFTT	Battle Force Tactical Trainer
BLII	Base Level Information Infrastructure
CINCPACFLT	Commander in Chief Pacific Fleet
CNET	Chief of Naval Education and Training
COMS	Contractor Operation and Maintenance of Simulators
COMPTUEX	Composite Training Unit Exercise
CSU/DSU	Channel Service Unit/Data Service Unit
DII	Defense Information Infrastructure
EGCS	Environmental Generation Control System
EVCS	External Voice Communication System
Exercise	A Battle Group combat systems training event that includes more than one ship
JTFEX	Joint Task Force Exercise
MEF	Middle East Force Deployer
MUTTS	Multi-Unit Tactical Training System
NAVSEA	Naval Sea Systems Command
Operator	A sailor who mans a shipboard console and uses the system during an exercise
OBT	Onboard Trainer, a part of the SQQ-89 sonar system
PMS 430	Naval Performance, Monitoring, Training and Assessment Program Office
TACDEW	Tactical Advanced Combat Direction and Electronic Warfare Trainer
TCD	Trainer Control Device, stimulates the SQQ-89 OBT
Team Trainer	A multi-ship simulated anti-air, undersea or surface warfare exercise
Trainee	An individual who receives training during an exercise.
Trainer	A training specialist
TSSS	Training Stimulation Simulation System
WCDSN	West Coast Distributed Simulation Network, the author's name for the simulated training infrastructure on the west coast of the United States.

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

This work was not a solo effort and I would like to acknowledge the help and guidance I received during my research effort. First, I would like to thank Professor San Miguel and CDR Hatch for their time and patience. Without their help I would not have been able to complete this undertaking. Their guidance was invaluable. Second, I would like to thank all those at FCTCPAC who helped with surveys, data and interviews. Their names are too many to mention and their time is greatly appreciated. In addition, I am indebted to and would also like to thank Mr. Wentz, LCDR Naman, Mr. Neff, and Mr. Taylor for their help gathering information from CINCPACFLT; as well as Greg Rose, Lee Ebersold, and Neil Clark who were extremely helpful gathering BFTT information. Finally, I thank my wife Cathlene for her patience during our first few months of marriage as I spent many a long night completing this project. Without her editing acumen I would never have completed this project.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION TO DISTRIBUTED TRAINING

A. BACKGROUND

Since the breakup of the Soviet military machine, the United States military has emerged as the world's strongest power. Countries such as China and Russia are similarly equipped and have forces in numbers roughly equal to the United States, but American forces remain better trained.

Since the United States military is not constantly engaged in battle, it must ensure that its forces are prepared and capable of fighting when called upon. Training maintains their readiness to complete the mission and prepares the forces for combat. As a result, training is an important segment of the military readiness schedule and focus of its peacetime preparations. This emphasis on training ensures that American forces are the best-prepared force in the world.

Ever emerging technologies are changing the way the Navy trains its personnel. The Director of Naval Training (N7) has stated that the Navy needs to incorporate more of this emerging technology into its training tools. To achieve this goal the training community and the fleet commanders must meet several challenges. First, they must decide which training technologies promote the greatest readiness. To accomplish this task Navy leadership must analyze and evaluate the different technologies available and determine which training methods provide the most economic return on investment while improving the learning process. Once this analysis has been completed the training community must plan, program and budget to acquire these technologies and ensure fleet implementation. [Reference 1.]

1. Forces Affecting The Training Environment

During the last seven years the Department of Defense budget has experienced negative or modest real growth. Fleet Commanders are faced with difficult decisions about how to best allocate their resources in the current fiscal environment of shrinking budgets. These fiscal constraints have increased the importance of discovering new methods to balance efficiency and effectiveness of resources. The ultimate challenge is to maximize Fleet training opportunities while using their crew time effectively.

Furthermore, safety considerations, mission complexity, instrumented range restrictions and the high cost of live training have limited the effectiveness and ability to conduct underway training. [Reference 3.] As a result, Fleet commanders must consider the effectiveness of alternative training solutions such as the use of simulation, to meet readiness and training requirements and supplement underway training days.

a. Changes to The Inter-Deployment Training Cycle

Moreover, the United States Navy has attempted to reduce the Inter-Deployment Training Cycle (IDTC) requirements. The IDTC ensures ships receive tailored training, maintenance and support in preparation for deployment. The Immediate Superior in the chain of Command (ISIC) and the ship's Commanding Officer (CO) are charged with the responsibility to ensure that their ships are prepared to deploy.

However, in the mid-1990's, the number of inspections and assist visits associated with the IDTC increased so dramatically that ships were being negatively impacted. The impact was that sailors worked long hours for months prior to deployment. Some studies have indicated that job satisfaction, Quality of Life, and retention suffered due to the preparations for these inspections and assist visits [Reference 4.] The Chief of Naval Operations (CNO), Admiral Johnson, recognized the effect of this increased workload and ordered a review. The findings of the review recommended a consolidation and elimination of a number of requirements, inspections and assist visits throughout the IDTC. More inspections, in preparation for deployment, did not proportionally improve readiness. The new focus of the IDTC is the efficient use of available resources, manage training and sailor's time.

b. Operating Constraints

While the CNO was reducing IDTC training requirements, the Navy reduced the number of underway operating days for non-deployed ships. Prior to these reductions, underway days per quarter during the IDTC had been increasing with the increasing requirements, inspections and assist visits. Figure 1 shows the reduction in operating days from thirty-four days per quarter in 1994 to twenty-eight underway days per quarter in 2001 for non-deployed ships. This also reduces the amount of underway training days for each ship. [Office of the Budget 2002 budget p. 2-4]

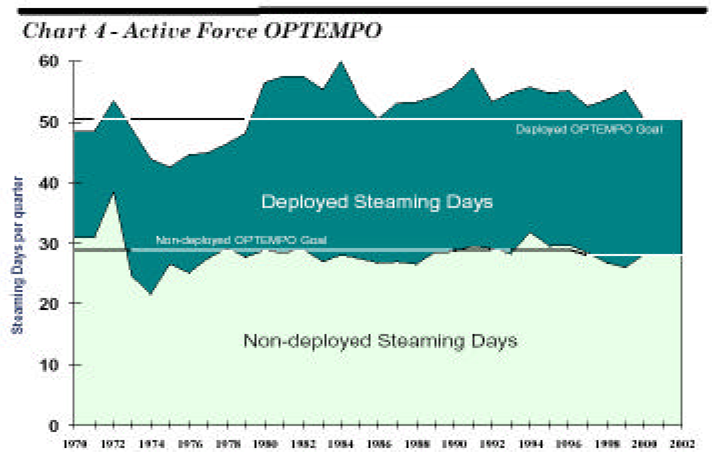


Figure 1. Navy OPTEMPO Trends

The reduction in underway days saved Fleet Commanders' operating dollars and the additional time spent in port improved the sailor's Quality of Life (QOL). The reduced operating time has forced commanders to review how they utilize scarce underway training days and seek training alternatives.

c. Environmental concerns

A newly emerging factor affecting ships capability to train is an increased concern about the environment and population creep near many long established training areas. Fleet ranges and training facilities are coming under increased pressure from the community and environmental organizations for a variety of reasons. Training schedules have been affected because ranges have been unavailable for use. [Reference 5] The most notorious example is the inability to use Vieques Island in Puerto Rico as a live fire training range for Harry S. Truman and George Washington Battle Groups due to the health and political concerns of Puerto Rican residents. Ships training in preparation for deployment at San Clemente Island in California have also experienced delays and loss of training opportunities due to environmental concerns. Several protected animals reside on the range's island and sea zones and such restrictions have forced commanders to seek alternative training.

d. The Resulting Pressures and the Alternative

Fleet Commanders must prepare Naval forces for war and contingencies with these constraints in mind. Alternatives to supplement underway training days must be developed so that ships deploy fully trained and ready to complete all assigned missions.

As a result, Commanders have turned to the use of simulated training as a preparation tool to supplement underway training days.

These are several of the reasons why commanders are more closely examining the use of simulated training in the IDTC. Simulation prepares deploying ships to operate in a multi-ship environment prior to underway exercises. Furthermore, simulation allows commanders to train their ships when operating dollars and other restrictions prevent them from getting underway for training. Simulation training also has the ability to train multiple units in a joint, synthetic atmosphere. In port training exercises allow ships to conduct more exercises during the IDTC by fully utilizing the time sailors have to train. Finally, simulated training allows reservists who drill on weekends to be trained with simulation instead of relying on limited underway training opportunities. Such weekend training increases their skill levels and readiness with minimal added cost.

2. The Commanders' View of Training and Simulation

In the geographically dispersed Third Fleet Area of Operations (AOR), there are five Carrier Battle Groups, four Amphibious Ready Groups (ARG) and a sundry of ships at various stages of the IDTC. Once Type Commanders individually train each ship they transfer them to the Operational Fleet Commander, for intermediate and advanced training and contingency operations. In 1997, the Third Fleet Commander stated that his focus was to ensure that his allocated resources were used efficiently to prepare these Battle Groups, ARG's, and other ships for joint and combined operations while on deployment. [Reference 6.]

In addition, in February 2000, the Second Fleet Commander and the Harry S. Truman Battle Group Commander emphasized the importance of the use of simulation as a tool to maximize the training benefit of group sail periods by beginning with in port multi-ship training. [Reference 7] The successful implementation and execution of a multiple ship in port simulated exercise was well-received as a supplement to current training procedures.

Commander Cruiser Destroyer Group One (COMCRUDESGRUONE), as USS CONSTELLATION Battle Group Commander, concurred with this assessment after the “successful use of BFTT (Battle Force Tactical Trainer) in an integrated, multi-unit scenario” during the Battle Group’s simulated in port exercise (BIGIE). COMCRUDESGRUONE stated that the exercise provided a “process of sequentially integrating training scenarios through IDTC events . . . and this approach offset training time compression in a shortened IDTC.” [Reference 36] The in port exercise was a key training enabler, in an IDTC shortened by 90 days.

Both the Commander in Chief of the Pacific Fleet (CINCPACFLT) and the Commander in Chief of the Atlantic Fleet (CINCLANTFLT) have stated in their training instructions that the use of organic training devices such as BFTT and other onboard trainers provide an excellent opportunity to satisfy training requirements without getting ships underway. [Reference 8] Both Fleet Commanders espouse the importance of using simulated training during the basic, intermediate and advanced phases of training and that such evolutions meet training requirements and provide equivalent qualifications for underway exercises. In addition, Type Commanders have utilized shore-based team training devices for Battle Groups exercises to maintain training proficiency. [Reference 9]

Type Commanders and Fleet Commanders have been outspoken about the need to conduct simulated training. They have responded to the issue of what required training can be replaced by simulation and recommended two possible ways to use simulation in the training cycle.

First, simulation could be used to completely replace underway training which includes all live fire training. This approach is highly controversial and the common view is that underway training is required and should not be completely replaced by simulation. The requirement to exercise the guns and missiles will always exist to ensure that the weapons systems work properly for a detect to engage scenario.

The second possibility is to use simulation to augment or supplement underway training. Simulation can be used prior to large training events to prepare ships for actual underway training events and prevent teaching operators the basics using scarce underway dollars. This initial training method is conducted in a realistic synthetic environment prior to underway ship or task group exercises. This process allows operators to learn in the safety of a supervised training environment. Operators can make mistakes and immediately apply those lessons learned to refine their skills prior to underway training. A proper balance of simulation and underway training should exploit the unique benefits of both the live and simulation training. [Reference 10] The Fleets have communicated that simulation based training provides an effective complement to underway training exercises and that onboard training devices shall be used. [Reference 9]

Specifically, Fleet Commanders have stipulated that simulation shall be used to supplement underway training when fiscal, manning, environmental, scheduling and other constraints restrict a ship's underway training opportunities. Again, simulation has been deemed an effective complement to and not replacement for, underway training.

3. The Simulation Situation

The fidelity and interoperability of simulation-based training has improved significantly with the growth of information and telecommunication technology. Previously, simulators and simulation were used primarily for single ship training. Sailors learned to operate fire control systems and radars within the ship but did not have the opportunity to interact with operators on other ships. More importantly, these operators and decision makers did not have the opportunity to plan combined missions and apply tactics with other ships within their battle group using simulators.

Advances in distributed simulation now provide Commanding Officers the opportunity to exercise their combat systems watch teams in a challenging, interactive and realistic environment. Ships and training commands are challenged with the task of utilizing this training tool to amplify its benefits while avoiding its limitations. In order for ships to train as they fight, the training systems, though distributed in location, must be capable of training together in a common synthetic battle space in which all units interact.

The ultimate goal of simulation systems is to train individual operators at the equipment level and to train decision makers at the battle force level. Simulation based training allows sailors to perform functions on their own consoles and subsequently to fight as they train. Additionally, such a simulation based training system, allowing operators and decision makers to train with other ships against realistic adversaries, currently exists in the Third Fleet AOR.

The current "West Coast Distributed Simulation Network" (WCDSN), the author's name for the system, allows Third Fleet Battle Groups to operate and train together without having to get underway. The WCDSN center of operations is at Fleet Combat Training Center, Pacific (FCTCPAC) in San Diego. FCTCPAC configures the network and creates scenarios based on objectives and multi-ship training requirements.

FCTCPAC conducts multi-ship Tactical Data Link (LINK), Middle East Force, Amphibious Ready Group, Warfare Commander, and Battle Group Team training. Each event is designed to meet the group or commanders objectives for the training and are tailored to emphasize specific warfare requirements as requested. The WCDSN has the ability to link ships in Pearl Harbor, Hawaii, San Diego, California and Everett and Bremerton, Washington thus allowing geographically disbursed units to train together without having to be in the vicinity of one another. Scenarios have been developed to train all mission areas including undersea warfare, air control, command and control, and surface warfare.

4. Discussion of Simulation and Underway Training

The expanded capability of trainers such as the Battle Force Tactical Trainer (BFTT) and the Tactical Advanced Combat Direction and Electronic Warfare Trainer (TACDEW) provides a nearly unlimited training capability for sailors to train using their own ship's equipment. This capability is not constrained by environmental, political and scheduling problems associated with the real world ranges, and underway training exercises. [Reference 11]

Shipboard simulators have become so advanced and realistic that there may be a tendency to treat them exactly like underway training. However, they are not the same as underway exercises in all aspects. Simulators may be limited in some respects, yet, may have some significant capabilities beyond underway training. These differences are important to consider when framing the discussion about the effectiveness of simulated training. [Reference 12]

a. Advantages of Simulation

- First among the numerous advantages of simulation-based training is the availability to provide immediate feedback to the operator. As soon as a scenario is completed, teams and watchstanders can immediately be debriefed, with a visual presentation. In comparison, live firing ranges frequently only offer oral debriefings with detailed briefings following several days or weeks later. The ability to receive immediate feedback enforces lessons learned during the training event. Additionally, if a simulated training event is evaluated as poor, the watch team can immediately be re-immersed in the same scenario to apply lessons learned.

- Second, simulated scenarios can be altered or stopped while an exercise is in progress. Frequently, watchstanders have the ability to handle more contacts in a scenario than expected. A simulated training environment can increase the operator's skill level by adding surface or air contacts challenges the watch teams, pushing each to improve. Such changes are frequently more difficult in underway exercises because of a lack of ships or aircraft to increase the threat level to make a scenario more difficult to the watchstander.

- Third, at times during underway training, ships are out of position, or not prepared to start an exercise at the planned start time due to equipment problems or other reasons. Valuable ship training time can potentially be wasted actually maneuvering ships and targets back into position. In simulation training the scenario can be reset at the correct position with little effort, potentially allowing more contact time, attack runs or time scenarios. The ability to pause and adjust a training scenario as needed maximizes the utility of training time

- The fourth simulation advantage is the ability to cue or prompt a junior watchstander to look for an event that might normally be missed. This tailors individual training. The ability to accomplish this during an underway exercise is often impossible due to the dynamics of ships, submarines and aircraft. A scripted simulation allows training team members to cue trainees and teach them what to look for on their console. [Reference 13]

- The fifth advantage of simulated training is that high-risk events can be completed or practiced in a safe simulated environment prior to being conducted at a live range. This allows a ship's CSTT to inflict simulated casualties to equipment or inject unexpected situations into exercises without risk of life or property damage. The learning can be accomplished in a safe environment and then applied during underway exercises.

- The sixth advantage of simulated training is that conducting exercises in port frees operating days for use for important events that can only be conducted at sea, such as navigation training and missile shoots. The Navy has been forced to reduce the number of operating days due to decreasing Operations and Maintenance (OM&N) dollars, increasing fuel and maintenance costs and an effort to improve QOL for sailors. All of these factors have placed a premium on the amount of time ships spend training underway. One way to maintain the same high level of training and reduce underway operating days is to conduct in port training.

- Seven, when simulation training is not effective for whatever reason, additional runs can be conducted. If a ship is not performing well the scenario can be stopped, played back to the watch team, and then started again ensuring the team "gets it right." Reconstructing a scenario while underway is often impossible because aircraft, vessels and ranges are needed for other events. This can be considered a version of "Just-in-Time Training."

- Eight, only simulated training offers the ability to freeze and playback a training event. A scenario may be frozen and stopped if the scenario requires the repositioning of ships, to make a teaching point to an operator or watch team or in the event of a safety violation. Training can be done on the spot and safety items can be dealt with immediately.

- Nine, an increasingly important consideration in the Department of Defense is the impact of environmental issues on training capabilities. During the last two years restrictions on the use of live training ranges, especially Vieques in Puerto Rico, have impacted the ability to prepare deploying battle groups and other ships for their future missions. Third Fleet has faced increasing pressure with wildlife restrictions on San Clemente Island. Eventually the fleet may lose the ability to use live ammunition on these islands. Simulated training augments live fire training and minimizes the impact of live fire training on locations where such training is politically and environmentally sensitive.

- Ten, in port training allows sailors to spend more time at home. An important goal of the recent IDTC reduction initiatives was to give Commanding Officer's the decision on how to best train his or her crew, including the amount of time his or her sailors spend at home. The CINCPACFLT Director of Training, Captain Lenfant, said, "that when sailors are at home they should train efficiently and spend time with families. The goal is to have ships and their people in homeport for 50% of the time during a five-year period leading to higher job satisfaction, higher retention and better word-of-mouth Advertising for recruiting." [Reference 14]

- Eleven, a ship can practice in challenging realistic environments in different global locations using simulated training scenarios. Instead of operating in Southern California Operating Areas, ships can place themselves and operate in the environment they will deploy to, such as the Persian Gulf. Simulated battlespace creates a realistic environment and includes such aspects as radar propagation effects in the area and will simulate actual terrain contours that accustom operators to the area to which they will deploy. Additionally, a ship can practice in multiple environments in one day. For instance a ship may practice in the Northern Arabian Gulf in the morning and proceed to operate off Korea in the afternoon. This adds to the realism of the training and the ability to use training time effectively.

- Finally, multi-ship simulation training provides the ability to immerse ships in a complex environment. Multi-threat air, subsurface and surface scenarios can be run easily. Bringing together the same assets to create an underway complex scenario can be extremely costly, time consuming and difficult. Adding to simulated scenarios can be as easy as adjusting a script by adding contacts and other events into an already created scenario. The ability to challenge watchstanders with complex, multi-threat scenarios is a key advantage to simulated training as compared to underway training.

b. Disadvantages of Simulated Training

There are many advantages to simulated training compared to underway training exercises but one should not neglect the disadvantages. Ignoring the shortfalls of simulated training can lead to uneducated decisions which may overlook some of the real benefits of underway training.

- The first disadvantage of simulated training is the presence of "simulator-isms." Many training devices inject unrealistic radar returns or force button actions by the operator when acquiring targets and firing that would not occur in an actual weapons system engagement. Operators may expect clear radar returns if simulated returns are crisp or develop other bad habits that should not be repeated in underway situations. Increasing the realism and fidelity of trainers can alleviate some, but not all, of these "simulatorisms." Training systems will continue to be improved thus reducing the risk of creating unrealistic displays and bad procedural habits. The solution is to find ways to work around these problems and most importantly to update systems.
- A second problem with simulators is that they are computer-based with potential software problems that can affect the realism of the exercise. Frequently, databases are not updated with the latest threats or changes to radar and weapon parameters. As ships return from deployment they often have more current information than the simulated training systems. The sailor may begin to unlearn what was learned during deployment. Inaccurate databases may train operators to look for threats that do not actually represent the environment in which they will deploy. Furthermore, tactics may change faster than databases for targets but this is also true for underway exercises. Similarly, simulators are increasingly using intelligent contacts and forces, preprogrammed to react to watchstander actions. Improperly updated tactics and models may lead to poorly trained operators. This problem should be corrected by frequently updating tactics and scenario databases or by trainers closely controlling enemy forces in a scenario.
- A third disadvantage of simulated training is that the operator may be subject to the stresses and challenges of the sea environment, or lack of sleep experienced by sailors underway. While this is not the most

important disadvantage of simulated training, many people feel that this decreases the realism of simulated training because stress and physiology affect the way people operate. Replicating conditions under which operators function at sea may increase the training realism.

- A fourth disadvantage is the possibility of computer failure while running the scenario or interruption of the network supporting the information exchange during the scenario. As systems and networks become more complex there is an increased likelihood a casualty would delay or inhibit training. Equipment casualties also exist during underway exercises, too. The risk of system failures may be reduced through proper maintenance and system design.

- A final disadvantage of in port, simulated training is the tendency to postpone or limit in port training to conduct repairs or other events that can only be done pier side. Frequently, in port training events are delayed or canceled because of scheduling conflicts. Too often, maintenance and meetings supersede training in port. This problem can be addressed by making in port training part of the IDTC and including time in a ship's schedule for in port training. Priority must be given to training weeks or events in port. In fact, CINCPACFLT has set aside time for training in port that cannot be tampered with. These training blocks will be set aside for ships to train without fear of inspections or interruptions interfering with training. [Reference 15]

5. What is The Cost of Such Simulation?

This thesis examines the cost effectiveness of conducting distributed training. This thesis will examine the costs associated with a distributed simulation network in the Third Fleet Area of Operations. Initial fixed costs associated with establishing the network and recurring variable cost per exercise and other support costs will be included. An analysis of these costs will determine the cost effectiveness of the network.

Fixed costs consist primarily of the system installation costs. This includes the installation of training devices on ships and the installation of communication equipment at each homeport node. Other fixed costs include the installation fees for establishing the communication network required to transfer data between homeport nodes. Finally, the installation cost includes the manpower costs associated with installing equipment at other locations using naval personnel.

Recurring costs are associated with each exercise or with training operators to use the training system. Each exercise requires additional manpower requirements by FCTCPAC to manage and conduct training exercises. Additionally, communication networks and equipment must be maintained and paid for to ensure connectivity between nodes. Third, equipment repair costs will be factored in to determine the cost to conduct each exercise. Finally, training specialists are needed to coordinate exercises, maintain databases, create scenarios and run the exercise. These people are an opportunity cost to the Navy as they could be used elsewhere to man ships or fill staff jobs. All these cost must be considered when evaluating the overall cost effectiveness of the training system.

B. PURPOSE

The purpose of this thesis is to qualitatively and quantitatively evaluate the use of a geographically dispersed simulation system to supplement underway training while maximizing readiness prior to deployment. This study will indicate whether the potential benefits from using distributed simulation training to augment underway training outweigh the cost of maintaining the system and training the system operators. This thesis' ultimate goal is to evaluate both the costs and potential benefits the Navy would achieve by utilizing the West Cost Distributed Simulation Network (WCDSN).

Additionally, this thesis will address the issue of the system's ability to provide a quality product that compares with underway training. While this research is not a comprehensive study of the west coast simulation network's ability to meet all needs, the thesis does seek to codify and explain whether the network fulfills the current Fleet training requirements. The system cannot be considered cost effective unless it meets Fleet training requirements.

C. SCOPE AND METHODOLOGY

1. Scope

This thesis addresses only the training effectiveness of the WCDSN and addresses issues associated with this system. Although a similar system exists on the east coast, this thesis is not intended to evaluate to the cost effectiveness of that network, which uses different systems, networks, training commands, and manpower for maintenance. The differences between the systems preclude any direct inferences from this research.

Second, the research is limited to an analysis of the costs associated with combat systems training only. The analysis does not address engineering, seamanship or other mission area training that routinely occurs onboard Navy ships while underway. The

WCDSN is not designed to support these mission areas. The use of combat systems simulated training to supplement underway combat systems training is assumed to have no impact on other mission area training. Likewise, this thesis is not intended to analyze the effect of training in other departments (i.e. engineering, navigation readiness, or maintenance issues). The assumption is made that no other mission area training is cancelled due to combat systems training being conducted in port as opposed to at sea.

Third, this research is not a complete analysis of simulated training versus underway training. This thesis does not aim to determine which simulations are the best for which mission areas. It does not seek to be a guide to writing scenarios nor does it determine whether simulation training benefits outweigh or replace underway training. This thesis will address some of the benefits and faults of simulation and the perception of people being trained by these systems. It does reflect the opinions of some fleet commanders and sailors and the cost effectiveness of this alternative training system.

2. Methodology

The fundamental benefit to be determined is whether conducting simulated combat systems training allows Navy leaders to deliver training to multiple locations without having to assemble ships in one location to train and operate together at sea. Battle Groups, Amphibious Ready Groups and Task Forces are frequently composed of geographically dispersed units that do not have the ability to train and operate together. The evaluated systems allow these units to train together more frequently at reduced underway cost.

The primary benefit is providing the ability to train locally without having to spend days at sea traveling to train together. The costs associated with sailing to a common location are a savings associated with using the training network and can be compared to the costs of maintaining the network. The cost savings associated with this training are the fuel and machinery costs, less the increased port utilities and the OPTEMPO days associated with the operating days saved by not training at sea and traveling to a training area.

Additionally, the WCDSN offers more opportunities to prepare sailors because the ship can train when it is unable to get underway. These benefits can be estimated by comparing the current cost of training to the cost of conducting these additional training events underway at ranges. The assumption is that simulated training events are needed and are equivalent to training events conducted at tracking ranges. The savings realized by conducting simulated training exercises is equivalent to conducting those same training events underway at these ranges because if such training were not conducted through simulation, underway training would be required. The cost-effectiveness of simulated training depends on the amount of training scenarios conducted and the number of training events per scenario, which must be considered in the cost effectiveness evaluation.

This thesis will estimate the cost effectiveness of conducting simulated exercises based on the assumptions above. Namely, infrastructure, manpower and other costs are incurred to conduct simulated exercises. These costs are compared to the fuel, manpower, maintenance, and other savings realized by training in port instead of underway. The following specific methods were used to collect information for this thesis.

a. Survey Methodology

A survey was conducted in order to receive feedback from the users of the WCDSN to determine the effectiveness of simulated training compared to underway training. It also addressed how the sailors who received training felt the system improved their abilities to fight the ship and how the system operated compared to their expectations. Six commands were surveyed for this thesis out of approximately seventy potential users of this system for a sample size of 8.6%.

Several surveys were used to analyze operator perceptions regarding the capabilities of simulated training. First, a survey was constructed specifically for this research to address the ability of simulation training to train operators. [Appendix A] The survey was conducted during the September 2001 Middle East Forces (MEF) Team Trainer on two of the three ships participating, the USS RUSSELL and USS FORD.

Two previous MEF Team Trainers surveys conducted in 2000 by Fleet Combat Training Center, Pacific were reviewed. The first of these two additional surveys was conducted after a distributed MEF Team Trainer in April 2000 in which, USS OLDENDORF and USS MILLIUS participated. [Appendix C] The survey was used to supplement the information gathered from the survey conducted specifically for this research.

The second additional survey was conducted during a MEF Team Trainer in March 2000 with USS OLDENDORF and CDS-23 participating in mockups at Fleet Combat Training Center, Pacific. This survey included written amplification of numeric responses to questions asked during the survey. This survey is included to compare simulated training onboard the ship to simulated training in a land-based mockup of a Combat Information Center.

b. Interview Conducting Methodology

First, interviews were conducted to follow up the survey conducted specifically for this research. Follow up questions were asked to several sailors onboard the USS RUSSEL and the USS FORD to gain insight into several of the answers and amplifying information. Numerical responses on surveys do not completely capture the response of the sailor receiving training. Therefore, questions were asked to clarify responses and amplify the answers to the survey.

Second, both face-to-face and phone interviews were conducted with specialists at several commands to gather information and data about costs, schedules, training plans, manning and other topics. Interview notes were taken, dated and annotated on information sheets.

c. Cost And Savings Data Gathering

The data for this thesis was collected from as many first hand sources as practical and deemed to be the most accurate. Cost data included information from contracts, command watch-bills maintenance databases, interviews, budgetary documents, and other supporting records from commands involved in the training network. Additional, data was found from research through public records available on the Internet and in general reference materials.

D. ORGANIZATION OF THESIS

This thesis will address five additional areas in the following chapters.

- The specifics of the training systems currently installed onboard west coast surface ships and the WCDSN so the reader has an understanding of the components required to create the simulated training network.
- The thesis will analyze the results of the surveys conducted for this analysis and address the appropriateness of simulated training.
- The thesis will conduct a detailed analysis of the costs associated with conducting distributed west cost training.
- The thesis will discuss several of the potential savings of conducting simulated battle force training as a preparation or supplement to conducting underway training.
- The thesis provides conclusions and recommendations about distributed simulation and its value as a training tool.

II. OVERVIEW OF THE WEST COAST DISTRIBUTED SIMULATION NETWORK

A. THE FOOTPRINT

The West Coast Distributed Training Network links the west coast homeports together in a virtual training battle space. The network is centered at the main shore facility, Fleet Combat Training Center, Pacific (FCTCPAC), San Diego, where this command administers the network and generates the scenarios, using Battle Force Tactical Trainer (BFTT) or Tactical Advanced Combat Direction and Electronic Warfare Trainer (TACDEW) (the BFTT family of systems), and broadcasts scenarios for use by Battle Groups and other deploying units. From FCTCPAC T-1 telephone lines connect the simulation network to each of the homeports where additional equipment, Multi-Unit Tactical Training System (MUTTS), broadcasts LINK-11, BFTT Tactical Data Link (TDL) and radio communications to the ships in Bremerton, Everett, San Diego, and Pearl Harbor. Two additional T-1 lines connect FCTCPAC to Naval Submarine Training Center, Pacific (NSTCPAC) and Submarine Training Center, Pacific (SUBTRAFAC) to enable submarines to participate through mockups at both facilities. Figure 2 illustrates the geographic area tied together by this simulation network.

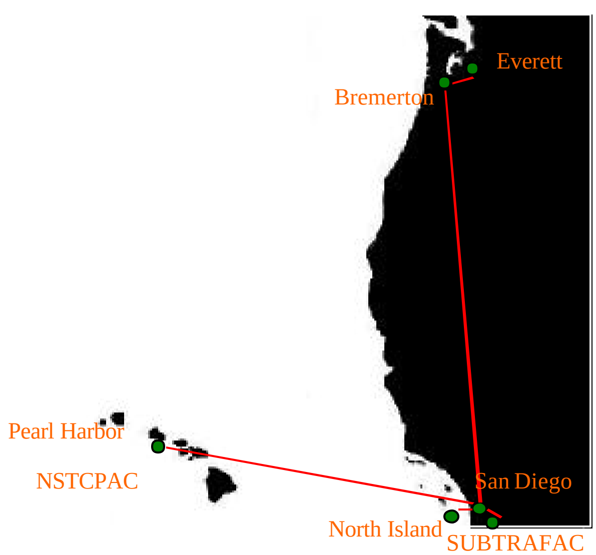


Figure 2. West Coast Architecture.

The BFTT family of systems provides the capability to conduct realistic joint warfare training across the spectrum of simulated armed conflict scenarios including; unit level team training in all primary warfare area, the means to link ships and submarines together located in different homeports for coordinated training and external stimulation of shipboard combat training systems. BFTT uses a distributed architecture to integrate onboard trainers to shore site trainers using DOD mandated Distributed Interactive Simulation (DIS) protocols. The system allows Battle Group/Force Commanders with the ability to conduct coordinated, realistic, challenging, interactive combat system training. [Reference 16]

B. CURRENT TRAINING SYSTEM CONFIGURATIONS

1. Shore Site Training System

Shore commands perform a vital role in conducting simulated training. The shore training sites provide personnel to maintain the communications networks used to connect homeport nodes, equipment and people to create scenarios used to train watch teams. Additionally, these shore commands can provide combat system suites mockups for ships and submarines to participate in exercises when ships are unable to train onboard due to equipment casualties or other commitments.

The three main shore facilities are FCTCPAC, NSTCPAC, and SUBTRAFAC. Each command has a different configuration that allows their stakeholders to participate in simulated training. Figure 3 contains a comprehensive diagram of a recent networked simulated training event involving the USS CARL VINSON Battle Group including subsurface assets.

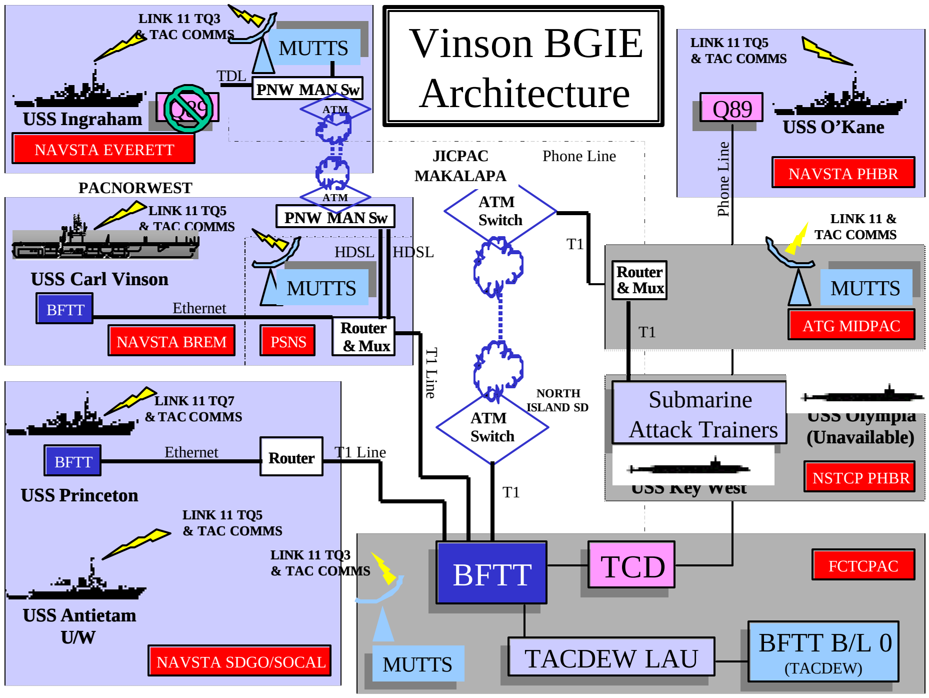


Figure 3. USS CARL VINSON BATTLE Group Training Network

a. Fleet Combat Training Center, Pacific, San Diego, CA

As the center of the network, FCTCPAC assumes the major responsibilities for linking the sites together and generating scenarios for battle force training. To accomplish this task FCTCPAC uses TACDEW, BFTT and various telecommunication equipments to distribute multiple warfare scenarios.

(1) Scenario Generation Equipment. TACDEW, also known as BFTT baseline 0, is a mature training simulation system first developed, by the Naval Air Warfare Center, Training Systems Division (NAWCTSD) in the early 1980's. This training device can drive up to 22 separate shipboard mockups and three separate distributed training scenarios at any on time. At TACDEW's heart is the Environmental Generation Control System (EGCS), which generates a synthetic threat environment with up to 2,000 tracks per scenario. The training system is capable of generating air, surface and subsurface contacts with a wide range of weapons, electronic emitters and landmasses. The training system consists of 24 operator consoles to adjust friendly and enemy contacts as needed throughout a training event.

A second important subsystem of TACDEW is the External Voice Communications System, which allows operators at the EGCS consoles to communicate with ships by radios. The system acts as a switching network that allows operators to communicate using the MUTTS system. The trainer is a legacy system and its fidelity is not as good as the BFTT Baseline 1 system. [Reference 16]

(2) TACDEW. TACDEW uses LINK-11 messages to distribute track data to NTDS capable ships so that they may be able to participate in simulated exercises. Many Pacific coast ships do not yet have BFTT Baseline 1 installed and they would be otherwise incapable of participating in an exercise until BFTT is installed on every ship. This makes TACDEW a necessary asset to the simulation network.

(3) BFTT. FCTCPAC also utilizes BFTT Baseline 1 as a stimulation/simulation system for fleet units that also have BFTT installed and uses the system to communicate to the submarine attack centers at NSCTPAC and SUBTRAFAC. Scenario generation and control are accomplished by system operators who interact through five BFTT Operator Consoles (BOPC's) located at FCTCPAC.

The BFTT system is electronically coupled to TACDEW through a LAN Access Unit that allows both systems to share a scenario and input additional contacts during the run. The LAN Access Unit does not allow either system to manipulate tracks created in the other system.

BFTT provides scenario generation and control capabilities similar to, but more advanced than the capabilities of TACDEW. In addition, this system captures and reconstructs track data, and displays it graphically on operator consoles onboard ships in different homeports during post-simulated exercise debrief.

Another vital capability provided by the BFTT system is the ability to train with submarine crews participating in the Pearl Harbor and San Diego Submarine Attack Centers. Because BFTT transmits data in a language, Distributed Interactive Simulation (DIS), that is understood by the attack center trainers, submarines are able to participate in combined warfare exercises. Contact and undersea environment data are shared allowing submarines to see a common synthetic picture with the geographically dispersed surface ships allowing the submarines and surface ship to train in a shared environment. This provides the capability for surface ships to operate with submarines prior to underway Fleet Exercises that is currently seldom accomplished.

BFTT is much more dynamic and capable and provides a greater level of user interaction with the scenario than TACDEW is capable of providing. BFTT provides over three times as many tracks and provides FCTCPAC personnel a more user-friendly interface with scenario which the operator can use to manipulate and add tracks easier than through the TACDEW system.

(4) Trainer Control Device. Surface ships receive their subsurface data through from BFTT data transmitted to the ship or from another system, the Trainer Control Device (TCD) that directly stimulates the sonar suite on surface combatants through their embedded training system. The Trainer Control Device (TCD) is a TAC-3 computer, installed at FCTCPAC, that allows up to eight ships to conduct multi-ship training simultaneously in a realistic environment shared with submarines at the attack centers. This underwater environment is common with the scenario generated in BFTT and TACDEW. [Reference 18]

Together BFTT, TCD and TACDEW provide FCTCPAC with the ability to generate dynamic scenarios that can be distributed to most surface ships through LINK-11 or BFTT TDL and to submarines at the attack centers. Only through this combination of equipment can a comprehensive multi-ship scenario be run with all battle group assets. Without the use of BFTT, for example, submarines would not be able to participate with surface ships and BFTT capable ships would not receive the high fidelity training they desire. Without TACDEW LINK-11, however, capable ships that do not have BFTT would not be able to participate. Finally, without TCD no surface ship would receive a common undersea environment.

(5) Shore Site Communication Equipment. Communication equipment and the ability to transmit scenario and voice data to geographically dispersed ships is vital to the success of distributed training at the battle force level. The voice communications allow ships to coordinate tracking and maneuvers in conjunction with the scenario. FCTCPAC uses several different modes and methods to send the scenario to participating units including signals over T-1 lines, UHF radio communication and satellite communication. Because the architecture uses all three of these paths the system

is flexible and has the ability to reach ships with different capabilities and is redundant so that the training can shift from one mode of transmission to another if one fails.

Line of sight, or UHF communications, are broadcast through the use of onsite radios and antennae or through MUTTS sites at each of the remote locations in Washington and Hawaii. UHF radio is used for voice communications for ships to talk to each other and to transmit LINK-11 data to ships so that they receive a common data picture and face the challenge of updating it as they would in an underway exercise. MUTTS sites contain up to 24 radios for voice and LINK-11 and receive the data from FCTCPAC for retransmission to units in the vicinity.

MUTTS Site	Radios	Couplers	Antennae	Additional Mutts Equipment
FCTCPAC, San Diego	(29) WSC-3 (UHF)	(7) OA-9123	(8) AS-390 (8) CA-1140	Main MUTTS Terminal(Timeplex equipment)
Everett, WA **MUTTS Van**	(17) WSC-3 (UHF)	(4) OA-9123	(2) AS-390	(5) VSRR
Bremerton, WA **Naval Shipyard**	(22) WSC-3 (UHF) (1) GRC-1771	(5) OA-9123	(6) AS-390	(5) VSRR
Pearl Harbor **ATG MIDPAC**	(20) WSC-3 (UHF) (2) GRC-211's (UHF)	(6) A-9123	(6) AS-390	(5) VSRR (for Secure Voice)

Table 1. MUTTS Site Equipment

Additionally, FCTCPAC has the capability to transmit LINK-16 and voice communication by satellite to ships capable of receiving this data. More and more Battle Groups are using combined LINK-11 and LINK-16 architectures when forward deployed and the ability of a Battle Group to use these architectures in a synthetic environment allows them to practice the skills of combining these two LINK's to provide a common picture prior to spending other valuable underway exercise time to learn. During the underway exercise they are able to apply what hey have learned in the simulated environment.

b. Submarine Training Facilities

The submarine training facilities also play an important role in the distributed architecture and have only recently been fully included in the training environment. While work needs to continue on involving submarines in realistic scenarios, the capability to interact with submarines prior to underway exercises or during limited interaction time at sea is vital. The ability for submarines to realistically participate in task force exercises exists in San Diego and Pearl Harbor.

Both submarine training facilities house multiple attack centers, which are mockups of submarine combat system spaces that can be used to train submarine crews. The attack center simulates multiple versions of the Los Angeles class submarine and provides watch teams the opportunity to track and target enemy forces as well as conduct strike missions. Tactical team training is conducted using CCS MK AN/BSY –1, CCS MK-2 Combat Control System simulators. These trainers are generally utilized in stand-alone mode but can be linked to other training systems in a combined environment. Additionally, all simulators are equipped with the Submarine Visual Training System that utilizes computer-controlled graphics to simulate periscope contacts and sonar displays that show acoustic information for operator training. All these systems are stimulated when the attack centers participate in exercises with surface ships. [References 19&20]

The capabilities provide watch teams and Battle Groups the ability to exercise coordinated submarine approach, attack and surveillance in a synthetic training environment. Submarine watch teams from these facilities can coordinate efforts with surface vessels and can communicate with them using a single plain voice communications circuit. Again, track data is received across a T-1 data line from the BFTT system at FCTCPAC.

2. Unit Training Equipment

Fleet units are equipped with several different types of training equipment. Different ships within a ship class will have different configurations of equipment used on each ship. These different configurations make it critical to know the capabilities of each ship prior to conducting training to ensure that the right systems are in use prior to training commencement. Additionally, training effectiveness is affected by the type of systems installed on a ship with the most effective training conducted on the ships with the most complete and newly updated systems.

a. Non-BFTT Capable NTDS and AEGIS Ships

All NTDS and CDS ships have the ability to receive Force Training Video (FTV) via LINK-11 messages. This training capability is embedded into the program and computer systems installed aboard the ship. The simulated radar and IFF messages are received as a frame to the normal LINK-11 message. The added information provides onboard systems with a simulated contact and updates its position every time a new message is sent out. Operators see a radar return on their screen and are able to track, target and attack targets as necessary. IFF information is also sent to give added reality to the simulation.

b. BFTT Capable Ships

BFTT capable ships are still a minority in the fleet but the numbers of ships equipped with this system has increased dramatically over the last two years and the installation rate has increased with the addition of $65 million of increased funding the next two years. Approximately fifty ships have BFTT or BEWT installed, over half of the West Coast surface combatants will have BFTT installed in some fashion in the next year, and sixty-nine ships will have BFTT or BEWT installed by 2003. BFTT capable ships have one or more of these components installed: BFTT with TSSS (Training Stimulation Simulation System) and NAVSIM, Radar Environmental Simulator System (RES), BFTT Electronic Warfare Trainer (BEWT), Air Management Node (AMN), and Carry-On Combat Systems Trainer.

(1) BFFT Subsystem. The BFTT subsystem installed on board ships is similar to the system installed at the shore commands. Depending on the size of the ship, the installation will include from one to five operator consoles and the electronics to interact with the radar and display systems on the ship. The system provides the same scenario generation and control, data recording, and communication systems at the shore sites and adds the network gateway for the ship to connect to the distributed training network through fiber optic cabling to the piers. [Reference 16]

(2) TSSS Subsystem. The TSSS system, formally identified as GNSS, generates the stimulation for radar sensors on board the ship based on targets generated in BFTT. This system utilizes a common interface and can be attached to numerous radar systems on surface ships and provides the radio or intermediate frequency signals needed to generate video and IFF data to operators in CIC. [Reference 16]

(3) NAVSIM Subsystem. This BFTT Subsystem provides simulated ship's navigation data (latitude, longitude, heading and speed) during any BFTT Training exercise. These data are vital for the coordination of all weapons and sensor systems associated with simulation and help keep all sensors participating in the same environment. [Reference 16]

(4) RESS Subsystem. BFTT uses this legacy training system aboard CDS combat systems suite ships to stimulate the SPS-48 and SPS-49 radar systems. This system allows the BFTT scenario generation system to interact with these radar systems to provide testing, training and command decision making for AAW scenarios on CDS ships. [Reference 16]

(5) BEWT Subsystem. BEWT is a PC based COTS system installed on most navy combatants for training in the EW environment for SLQ-32, ULQ-16 and WLR-1H EW systems. This system can be installed alone or in conjunction with BFTT. By itself it allows added reality to LINK capable ships to participate in an intense EW environment. Integrated with BFTT the tool will generate electronic signals coordinated with the radar and returns and provides analysis tools to evaluate the performance of EW operators and teams. The system contributes to the combined environment and creates added realism for trainees. [Reference 16]

(6) Air Management Node Subsystem. This complex system is installed only on LHD class ships and provides realistic Air Intercept Controller (AIC) training during multi-ship scenarios or for individuals in stand-alone mode. It operates with the main BFTT system to provide a realistic air picture and is intended to stress AIC and command and control decision makers in a realistic environment by allowing AMN operators to control up to 20 aircraft at a time. The system also provides the capability for shipboard air controllers to control simulated aircraft through voice recognition software, eliminating the need for training system operators to fly the aircraft in the scenario.

(7) Carry On Combat Systems Trainer. This system replaces the older combat systems training vans that used to connect to ships combat systems suites for training and upgrades the system so that it is DIS compliant. COCST is a mobile unit carry on set of boxes that can be moved from ship to ship to provide a temporary training capability to ships not equipped with the BFFT system. Ships with this system can connect it to the training network and participate in an exercise the way BFTT capable ships participate and receive radar and other track data directly through their ships combat systems suites.

The combination of these systems allows the training network to include ships from all ship classes with multiple combat systems. The architecture relies on the combination all these systems to provide realistic training to the entire Battle Group. Together the systems allow all units to participate in task force exercises and realistically contribute. Without any one system, individual units would not be able to participate and the benefit of conducting simulated training would diminish.

III. SUITABLITY OF SIMULATION TRAINING

A. SURVEYS OF SYSTEM USERS

A principle factor in the decision of whether simulated combat systems training is an effective supplement to underway training is if it meets the operators' needs and training requirements. In order to address this issue, several surveys among select users who participated in simulated training during the last three years were used to evaluate trainee's opinions.

1. Description of Surveys Used

This thesis used three separate surveys to analyze simulated exercise trainee satisfaction. The first two surveys were created by FCTCPAC to gather feedback from users of their training facilities and that had participated in a distributed training scenario. [Appendix B & C] The third was created specifically for this thesis to analyze exercise participant attitude about the appropriateness of simulated training. [Appendix A] The results from the first two surveys were used to supplement the survey created specifically for this thesis and to increase the sample size.

2. A Description of the Sample

The three surveys used for this thesis were distributed to ships participating in training exercises during the writing of this thesis or were the most recent FCTCPAC surveys. The combination of all three surveys creates a sample that is reasonably representative of the Pacific Fleet. A larger sample could not be surveyed due to the small number of units scheduled to participate in simulated exercises during the thesis timeframe. The two historical FCTCPAC surveys were selected to supplement the survey created for this thesis and increase the sample size to include the widest possible range of individuals, ship types and geographic locations. All three surveys were conducted in 2001 and 2000 and reflect recent attitudes toward simulated training.

All three surveys received responses from a diverse range of people. E-1 to O-3 responses to the three surveys provided important data from all levels of the ship's chain of command. However, the sample does not exactly mirror rank distribution throughout the Navy.

Additionally, the three surveys include responses from a wide variety of units, including Destroyer Squadron (DESRON) Staff, and FFG, DD and DDG crews. Notably, CVN's, CG's and amphibious ships were not included because none participated in the analyzed training events. While this does not include the full range of ships capable of using the network, the sample does cover representative users and ships with different simulation equipment configurations.

The sample included six of the 80 ships that can use the WCDSN to conduct multi-ship training for a sample of approximately 7.5% of the population. Within each participating unit approximately 12 out of the 25 crewmembers participating in the event responded to the survey for a response rate of nearly 50%. This sample was deemed large enough to be statistically significant and to reliably represent fleet attitudes about simulated training events.

Finally, the three surveys included units from multiple geographic areas. The sample consisted of ships homeported in San Diego and Hawaii. The purpose of including ships from more than one port within the Third Fleet area of responsibility was to avoid geographical area bias.

B. SURVEY FINDINGS

1. FCTCPAC Survey Following Distributed MEF Team Trainer for USS MILIUS AND USS OLDENDORF.

This survey was used to determine the ability of simulated training exercises to meet the needs of the trainee. The survey, Appendix C, addresses several issues related to simulated training in general. For the purpose of thesis, only the first five questions were analyzed. The reason for this is twofold. First, these five questions are similar to questions addressed by the survey designed specifically for this thesis. Second, these five questions apply directly to the ability of the scenario, itself, to provide a realistic training experience. The final two questions in Appendix C about the Training Liaison Officer and the training binder did not pertain to the capabilities of simulated training and both these questions were excluded.

a. Scales Used in the Survey

This survey asked the respondent to rate his or her agreement with how well the training met his or her needs in specific categories. The scale used in this FCTCPAC generated survey was formatted as follows:

1 – Strongly Disagree (Unsatisfactory)

2 – Disagree (Lacking/Marginal)

3 – Agree (Satisfactory)

4 – Strongly Agree (On the mark/Very Good)

5 – N-Not Applicable

b. Interview Procedures

Because this was a historical survey, personal interviews with those completing the survey were not possible. However, information gathered from written comments was used to amplify individual answers to survey questions.

c. The Survey Process

The survey designed by FCTCPAC involved the following survey procedures:

1. Training was conducted onboard the participating ships for three days.
2. After the final training scenario, the Combat watch teams on each ship were gathered and told the purpose of the survey.
3. Individuals were asked to fill out the survey and provide feedback on the training and how it met their needs. The survey primarily focused on the abilities of FCTCPAC to meet the needs of the trainee.
4. Group members were informed that they should provide written comments on the survey, as needed, to stress particular shortfalls or areas where training exceeded expectations.

d. The Survey Results

An examination of survey responses provided the following information.

(1) Were the Scenarios Realistic? Overall, respondents from this exercise believed that the scenarios were realistic. Eighty-three percent of the respondents answered favorably when asked if scenarios were realistic representations while only eleven percent believed that the scenarios were unrealistic.

Although the belief that scenarios were realistic was statistically consistent between all ranks, the chiefs and officers were slightly more impressed by the realism of the scenarios than the E-4 to E-6's. Rank was not a primary indicator of who believed the scenarios were realistic, however. (Appendices J, K, M, T.)

Written responses indicated that the simulation was reliable, overall, and lack of realism was due to radar representation difficulties and IFF not received by the ship. In these cases, air contacts were not updated frequently enough to maintain situational awareness. This update rate problem impacted the ability of some operators to train effectively. Note, this scenario was broadcast using TACDEW and the older Force Training Video (FTV) representations, which are slower than the BFTT updates. Added realism of newer, faster simulation systems may help increase the realism of simulated scenarios and the value of training.

(2) Did the Volume of Tracks Provide a Realistic and Challenging Environment? The sample surveyed believed that the volume of tracks were sufficient and provided challenging training, although, a significant minority was dissatisfied. Two thirds of those sampled believed the volume was sufficient while one third did not (Appendix J.) The Chiefs and the junior enlisted were less satisfied with the volume of tracks than the officers (Appendices K, L, M). Overall, enlisted respondents still held a favorable opinion of the volume of tracks.

Written comments provided insight into why some respondents were disappointed with the volume of tracks. The Sonar Technicians and Air Warfare watchstanders were disappointed with the volume of tracks.

None of the three scenarios in this exercise significantly challenged the sonar technicians. Sonar Technicians on both ships complained of little contact time with enemy submarines and felt that the scenarios did not provide challenging training. The reason for the limited sonar training, however, was that the scenarios were written with an emphasis on surface Maritime Interception Operations (MIO) in the Persian Gulf and not to target USW training. Such exercises include a low subsurface threat and few subsurface contacts were included at the warfare commander’s request. Thus, the Sonar Technician responses reflected the emphasis on Surface and Air warfare training.

Dissatisfaction with the number of air contacts was expressed in the comments received from the Aegis destroyer, whose primary mission is Air Warfare. Air Warfare watchstanders indicated they had trained with greater numbers of air contacts previously and desired more challenging scenarios. In future scenarios the sonar and air warfare comments could be addressed by scripting more contacts to the training scenario. These are not issues associated with the ability of the scenario to accurately train operators and are easily remedied.

The fact that, overall, the respondents believed that the number of contacts was sufficient is important because a comparison of the number of tracks to the perception of the scenario being realistic indicates that the two are closely related (Appendix T.) A scenario that contains a sufficient number of tracks is a good indicator that the scenario is realistic to a 95% level of significance. Training commands can use this information and create scenarios with more tracks to construct exercises that are realistic and challenging for ship crews.

(3) Did the Scenarios Provide an Opportunity for the Training Needed by You on Your Ship? Seventy-one percent of respondents believed that they received the training needed by their ship Again, the officers were marginally more enthusiastic about the training and junior enlisted personnel provided the greatest number of negative responses. The difference was not statistically significant.

Most negative responses were written by Sonar Technicians who felt that the scenarios should have emphasized more USW tactics. Air Warfare watchstanders felt that the exercise provided the training they needed even though they desired more contacts in their training scenarios.

All comments about the training at individual stations were favorable, indicating that the scenarios provided quality training at most watch stations. Comments indicated that the scenarios were "great training for AAWC (air warfare training)" and a "great training opportunity for surface tracking." Senior watchstanders also wrote that they received “excellent experience coordinating watch teams and reporting targets of interest to other ships”.

(4) Were the Disclosures Adequate to Maintain Situational Awareness and Were They Made in a Timely Manner? The answer to this question was a

strong yes, with eighty percent of the sample responding favorably. It is important to note that the vast majority responded that the disclosures were satisfactory, but not strongly agree. Few responded with a strong negative or strong positive feeling about the disclosures. This indicates that the crews believed the disclosures were adequate and none were extremely pleased or displeased with the disclosures.

Written comments indicated that verbal disclosures greatly enhanced the realism of the scenario and the ability of the watchstander to gain situational awareness. The trainees indicated that radio communications from the targets were critical to their situational awareness and are a crucial element to the success of the trainer. Trainees stated that radar data without realistic simulated communications with contacts is not an appropriate or realistic training experience. Trainees also stated that disclosures were especially helpful when radar data was slow reaching the ships and that these disclosures helped maintain the flow of the scenario.

The supported the conclusion that disclosures were helpful. This data from the regression analysis in Appendix T indicates that the realism of the scenario is directly related to the timeliness and adequacy of the disclosures used in the scenario at a 98% level of significance. Operators, who indicated that the disclosures were both timely and necessary, thought that the scenario was realistic. Training commands can use this information to improve their scenarios by adding more realistic disclosures. 5. Summary of Findings for this Survey The responses from this survey indicate that the training received from this scenario generated by TACDEW was beneficial with clear training benefits. The survey provided information to improve future exercises. First, the scenarios were realistic and provided valuable training to operators at all watch stations. PMS 430 (Program Manager Surface 430) and commands responsible for designing the simulators used for training must provide the operator with a representation at his or her console that is a realistic representation of what that operator will see when deployed. Overall, respondents are satisfied with the current state of the simulation but wish to see continued simulation improvement.

Second, the surveys indicate that trainees desire intricate, challenging scenarios with many tracks. Trainees were more satisfied when they were challenged and felt their time was better spent participating in exercises with numerous contacts. Training commands can increase the value of the training they provide by continually updating scenarios and increasing the number of tracks presented to the trainee.

Finally, training commands must continue to invest time to create accurate voice disclosures to supplement the simulation. Radio communications and simulated verbal reports from bridge lookouts are nearly as important to the scenario as the actual radar representation on the watchstander's equipment. Until simulators provide these verbal cues, training commands will have to continue to provide this verbal interaction.

2. Survey Results From MEF Team Trainer USS OLDENDORF AND CDS 23 in Combat Systems Mockup at FCTCPAC

This MEF team trainer was conducted in the Combat Information Center mockup at FCTCPAC prior to the Distributed Team Trainer for DESRON 23 and the USS OLDENDORF. The mockups were used because combat systems upgrades were being installed on USS OLDENDORF and the training could not be held onboard the ship. This survey is included in the analysis for two reasons. First, the survey addresses the realism and appropriateness of the scenarios and helps indicate whether simulation is a suitable method of training. Second, the surveys provided a basis for comparison of simulation exercises in a mockup and simulation exercises onboard ship, using the crew’s own equipment. This survey was not written for this thesis but provided by FCTCPAC.

a. Scales Used in the Survey

This survey asked the responder to rate his or her agreement with how well the training met his or her needs in specific categories. The scale used in this FCTCPAC generated survey was formatted as follows:

1 – Strongly Disagree (Unsatisfactory)

2 – Disagree (Lacking/Marginal)

3 – Agree (Satisfactory)

4 – Strongly Agree (On the mark/Very Good)

5 – N-Not Applicable

b. Interview Procedures

Once again, this historical survey precluded personal interviews, but written comments to survey questions were examined to provide additional information for analysis.

c. The Survey Process

The survey procedure for this survey designed by FCTCPAC involved the following procedures:

1. Training was conducted at FCTCPAC for three days.
2. After the final training scenario, the Combat watch teams were gathered and told the purpose of the survey.
3. Individuals were asked to fill out the survey and provide feedback on the training and how it met their needs. The survey primarily focused on the abilities of FCTCPAC to meet the needs of the trainee.
4. Group members were informed that they should provide written comments on the survey, as needed, to stress particular shortfalls and areas where training exceeded expectations.

d. The Survey Results

An examination of survey responses provided the following information.

(1) Ability of Mockups to Meet the Individual's Training Needs. Three factors influenced the ability of the scenarios in mockup combat suites to meet the ship's training needs: the safety of the equipment, the material condition of the mockups and the age of the equipment. These three factors are significant at a 95% level of significance.

The equipment in the mockup was safe and presented a good representation of the Destroyer (DD) CIC. Watch teams stated that the mockups were well prepared by FCTCPAC staff and provided a safe learning environment. As such, the sailors were able to concentrate on the scenarios and learn. [Appendix S.]

The age of the equipment was the greatest problem, however. Seven of the fourteen surveys indicated that the equipment in the mockup was old and difficult to use. Fifty percent of the surveys said that the training equipment was not in good condition. Trainees in the destroyer mockup provided the majority of the negative responses while the DESRON staff was very pleased with the Flag watch command center.

The difficulty with the CIC mockup was that the consoles and radar repeaters were older versions than those in use on ships. The mockups are not updated as frequently as those onboard ship because shipboard equipment updates have a higher priority than updates to shore based training facilities. This is not the fault of the training command but is a factor in the usability of the mockup. This older software and equipment created an unrealistic environment that made training more difficult. Sailors indicted that they first had to learn to use the equipment before they could learn from the scenario. The comments also specify that they prefer training on their own equipment on the ship and looked forward to the distributed exercise to be held onboard their ship in the following month.

Regression analysis indicated that good equipment is a strong indicator of the scenario being realistic and challenging at a significance level of 95%. As the state of the equipment improves, so does the training. The training benefit was degraded because the equipment was older and not the same as the ship board equipment. [Appendix S.]

Overall, the mockups were effective because the sailors found them to be safe and usable and the training scenarios written by FCTCPAC were challenging. The mockups provided training that was realistic enough to gain benefit, but sailors would have preferred to learn on their own ship's equipment.

(2) Realism of Training. The sailors participating in this event also indicated that the scenarios were realistic, challenging and appropriate. This supports the earlier data from the previous two surveys that simulation can be realistic and that the scenarios created by FCTCPAC provide realistic training for watch teams. Eighty-six percent of the responses indicated that the scenario was realistic and challenging. Also, survey comments specifically noted the number of contacts and the realism of the threats provided excellent training opportunities.

3. Thesis Specific Survey Following Distributed MEF Team Trainer for USS RUSSEL AND USS FORD.

This survey was created to determine the ability of simulation training to meet the needs of the trainee but included more specific questions than the post exercise survey used by FCTCPAC. The survey focused on satisfaction with the training event and provided answers to questions about why the simulated training was successful or not. To analyze responses by different categories, questions on the respondent's rank and whether an individual was on the training team were included. .

Specifically, the survey asked for the respondents' attitudes on training in six specific areas: command and control, communications, multi-ship operations, tactics, individual skills, and realism of the scenario. [Appendix A] The answers to the twenty-seven questions provide the most detailed information about the suitability of simulated training exercises.

The questions for this survey were developed using previous experience and input from interviews of current FCTCPAC training officers. During interviews FCTCPAC training specialists were asked which specific mission areas were important to MEF training exercises and which missions were critical to the success of the training event.

a. Scales Used in the Survey

The survey designed for this thesis included one additional scale to provide a slightly more refined range of responses for each question. The six scales were formatted as follows:

1 – SA - Strongly Agree

2 – MA - Mildly Agree

3 – U – Undecided

4 – MD – Mildly Disagree

5 – SD - Strongly Disagree

6 – N/A- Not Applicable

b. Interview Procedures

Interviews were conducted and direct follow up questions were asked of participants in this survey. These interviews were considered important because they provide the analyst with additional information that cannot be expressed numerically on a survey. Specific questions were asked about extreme answers and to people who marked an excessive number of "Not Applicable" responses.

c. The Survey Process

The survey designed for this analysis involved the following procedures:

1. Training was conducted onboard the participating ships for three days.

2. After the final training scenario, the Combat watch teams on all ships were assembled and told the purpose of the survey.

3. Individuals were asked to complete the survey about simulated training and their views about how this training event prepared them to operate in a multi-ship environment.

4. Group members were informed that their feedback was anonymous and that they should feel free to add written comments on the survey as needed.

5. Members were encouraged to provide oral comments to the survey administrator after completing the survey. Interviews were conducted to follow up on responses.

6. Final questions were asked to interested members who remained and wanted to provide additional feedback.

d. The Survey Results

An examination of survey responses provided the following information.

(1) Command and Control Questions. Questions one through five asked about the exercise's ability to address command and control training needs. Individuals in the survey responded favorably, that the trainer successfully taught them command and control procedures. Specifically, respondents were very satisfied with the knowledge they gained about which warfare commanders they reported to within their Middle East Force (MEF.)

Sailors also indicated that they have a much greater understanding of the group's OPTASKS because they were able to apply the written words that they had read, in a realistic environment. Several of the individuals interviewed after the survey indicated that this was their "first opportunity to truly use the guidance" from group commanders. The training, prior to their underway Middle East Force Exercise (MEFEX) provided an opportunity to learn and apply these OPTASKS.

The least enthusiastic response from this series of questions was about the ability of the trainer to teach the sailor the importance of LINK management. In interviews conducted following the training, sailors responded that the scenarios used for this particular trainer did not involve LINK-16 because only one ship was capable of transmitting LINK-16. Therefore, they did not give LINK training the highest marks. Sailors also indicated that they would like to increase the use of LINK-16 in simulated training events because they realize they will be required to use it during deployment.

Notably, there was no significant deviation of answers by rank or by people on the training teams. E-4 to O-3 noted significant training value from the event. All ranks indicated slightly less satisfaction with the LINK training. This shows that command and control training was effective for all watch stations, from the most junior to the most senior sailor. [Appendix P]

Regression analysis of survey results indicates a strong link between the understanding of command and control procedures, the realism of the simulation and how well the scenario taught surface, subsurface and air warfare tactics. The ability to teach tactics and realism of the simulation were both positively correlated to how well the sailors learned their task group's OPTASKS. Those who thought the scenarios were realistic and provided tactical training learned to apply OPTASKS and felt more confident in their ship's ability in the task group. This indicates that simulated training exercises may provide a good environment to learn to apply OPTASKS prior to underway exercises. [Appendix O.]

(2) Communications Questions. Questions six through nine asked questions about the exercise's ability to address communication training needs. Again, these responses indicated that watchstanders at all stations received good communications training. Over seventy-five percent of responses indicated that the exercise provided valuable communications training. The responses also indicate that individuals had a better understanding of who to report contacts to, both on and off the ship, in all warfare areas. This indicates that all watchstanders, regardless of their assigned mission area received significant communications training.

The only notable less enthusiastic responses were from non-training team members, who manned the consoles during the exercise. Sixty-three percent responded favorably and only ten percent responded unfavorably. The junior watchstanders interviewed indicated that they received valuable training for internal communications but that the majority of the off-ship communications benefit belonged to the senior supervisors. In interviews, one of the most repeated benefits of the training scenarios was the opportunity to operate and communicate together. Operators were able to "get to know the person," with whom they would deploy to the Persian Gulf. This training opportunity is invaluable because sailors who operate together communicate better, know what questions to ask and information to report. Scenarios offered the opportunity for this invaluable personal interaction and communication prior to underway training events.

The regression analysis regarding communications training indicates that learning to report air contacts, learning who their ship reports to, and understanding their task group's communications procedures are the most important aspects of learning to communicate in the multi-ship training environment, at a 95% level of significance. Air warfare reporting procedures are more important than surface or subsurface procedures because of the speed of the air warfare scenario and the need to effectively communicate. Future training events will benefit by concentrating communications training in air warfare and other scenario critical areas. [Appendix O]

(3) Multi-Ship Operations. Questions ten through thirteen asked about the exercise's ability to fulfill multi-ship training needs. Because this was a multi-ship trainer and the first opportunity for these ships to operate together, the ability of the exercise and its scenarios to create a good learning experience for multi-ship operations was vital. If task force training was to be conducted on a meaningful level in a simulated environment, the training needed to teach operators to work together in a task group.

Overwhelmingly, the respondents to the survey indicated that the trainer did provide excellent training in a multi-ship environment. One hundred percent of the respondents indicated that the scenarios helped them understand their ship's duties in the Task Group. This response was similar across all ranks and between training team members and non-training team members, indicating that operators, supervisors and decision-makers benefited from the training. Regression indicates that junior sailors may have learned more about tracking contacts and coordinating these tracks with other ships. [Appendix P] This is likely because junior personnel received more hands on equipment training than senior watchstanders, who should be the decision makers. This is not an area of concern because decision makers should not be involved in tracking contacts.

Responses not only indicated that the scenarios reinforced their understanding of task group operations but also made them feel more confident in their ability to operate with the other ships in the Task Group. Operators felt much more confident in their ability to coordinate tactics with other ships in their group. Interviews indicated that this exercise provided a significant boost to watchstanders' confidence in their partner ship's abilities in the MEF. The exercise had familiarized both ships with each other's operating procedures. This familiarity brought confidence.

Several sailors indicated that they had been confident in their own ship's abilities but did not know how well other ships in the MEF would interface. The trainer provided the answer for these individuals because it allowed these ships, one homeported in Hawaii, one in San Diego and one in Everett, to gain experience operating together for the first time. Importantly, the crew also stated that the training had adequately prepared them for their MEFEX phase I, the underway training for their task force. This indicates that the simulated exercise was good preparation for underway training and allowed the crew to learn the basics of operating together prior to an underway exercise.

(4) Tactics. Questions fourteen through seventeen asked about the exercise's ability to meet tactical training needs. Overall, respondents from the ships indicated that they received satisfactory tactical training from the three scenarios. The results were favorable in all warfare areas, but Undersea Warfare had a significant amount of negative responses.

Sailors interviewed after the training indicated that only one scenario included any significant submarine contact time and that the majority of the time was spent training Air Warfare and Surface Warfare concepts. Sonar Technicians said that they understood this focus because Surface and Air threats are predominant in the areas where they will deploy, but also wanted additional USW skill and tactics training.

The shortcomings of USW training in the scenarios did not taint the overall perception that valuable training was achieved. Future trainers may consider whether including more sonar contact time is prudent or whether the exercises should continue to focus on air and surface warfare. One option may be to exclude undersea warfare (USW) training because the time needed to prepare the sonar systems for training can be excessive.

Air and Surface Warfare were the two best-trained mission areas according to the surveys. This is valuable information because both missions were the primary training focus for this exercise. These are the most common missions that the ships will encounter in the Persian Gulf and the trainer was designed to challenge watchstanders in Surface and Air Warfare. The scenario and simulations provided significant challenges and tested the operators in both warfare areas.

Regression analysis indicates that practical experience applying preplanned procedures and Operational Taskings (OPTASK's) is critical to tactical training at a 95% level of significance. The surveys also indicated that the biggest indicators of a successful MEF team trainer were the ability of the scenario to teach surface and air warfare tactics. This is expected, because most MEF deployers are sent to operate in areas where these skills are the most needed. The survey results confirm this relationship and indicate that future distributed team trainers should continue to concentrate on the realism of air and surface warfare scenarios to provide the greatest utility to the ships. [Appendix O]

(5) Individual Training Objectives. Questions eighteen and nineteen asked about the exercise's ability to address the training needs of the individual. Respondents indicated that they received valuable and realistic training at their individual watch stations. Eighty-four percent of sailors stated that they felt more confident in their ability to perform their duties as a result of this training event. This section provided important information about the simulated training for the individual.

First, the individuals who responded that they did not receive significant training at the operator level were all members of the training teams. Although many training team members indicated in interviews that they received training value from the scenarios, many of the training team members said they were so involved in helping run the exercises that they were not able to focus on training themselves. This is a significant finding and indicates that training team members may not be able to gain as much training value from these exercises as the actual watch team members do.

Second, respondents to the survey indicated that the scenario provided realistic representations at their watch station. It is important to note that participants believed that the training was realistic overall but were not excessively impressed with the simulation's fidelity. During interviews, the greatest displeasure was that the air contacts were not being updated fast enough by TACDEW through the LINK broadcast. With simulated aircraft traveling at high speeds, delays meant poor tracking training. All these interviewees indicated that valuable training in tracking and reporting was achieved despite the minor problems.

(6) Realism of the Training Event. Questions twenty and twenty-one asked about the realism of the exercise's simulation. Respondents to this survey were asked to evaluate the realism of the training scenario two ways. First, they were asked whether the scenarios were realistic with real threats and tactics. Second, they were asked whether the simulations were realistic. Together these questions address the content of the scenario and the representation of the scenario to the trainee.

An analysis of the responses indicates that the scenario more than met the needs of the watch sections and that the events within the scenario were accurate representations of experiences during real deployments. Seventy-six percent of respondents responded favorably with over 55% indicating that they strongly agreed that the scenarios were challenging and realistic and was reinforced by post-survey interviews.

One Chief Petty Officer and sailor commented "this represented a real week in the Arabian Gulf. We were forced to spend time querying and tracking ships. It wasn't just a typical 'shoot'em up' exercise where you were graded on how many missiles you could fire." Additional comments pointed out that trainees were pleased that they received realistic training in all warfare areas and were forced to coordinate ship boarding and air defense with other ships in a combined warfare scenario.

Electronic Warfare Technicians (EW's) indicated that certain threats encountered in the exercise were not included in the Order of Battle and were not realistic in the Arabian Gulf, causing negative responses. Otherwise, EW's stated that the scenarios were helpful and that the electronic warfare information was provided in a timely enough manner to organize and analyze the data.

Sailors also felt that the simulations used during the training event were realistic. The survey returned no negative responses but most written comments stated that the sailors were undecided or only mildly agreed that the simulations were realistic. Again, this scenario was created using the older TACDEW system and sailors said that track updates received through the LINK-11 messages were slow for air warfare training, degrading the realism. Sonar technicians, Electronic Warfare technicians, Surface and Air Trackers indicated that the data at their consoles provided adequate or good opportunities that realistically depict real world events.

(7) Ability of Simulation to Replace Some Underway Training. Question twenty-two pointedly asked the people who received this simulated training whether they believe that multi-ship simulated exercises can replace some underway training. The people who use this training can provide the best feedback about the capability of simulated training and its ability to replace underway requirements. The crew's answer is a strongly worded "yes."

Eighty-one percent of those surveyed state that they believed that simulated multi-ship scenarios could replace some underway training. Several people were undecided but, importantly, <u>no</u> respondent indicated that they even mildly disagreed with the ability of simulation to replace underway training. Regression indicates that no relationship exists between rank and the perception that simulated training can replace underway training. [Appendix P]

One sailor who was undecided indicated that he believed that simulation would replace a majority of underway training but that he would like to see more realistic representations. He stated that the fidelity of the air radar simulation should be improved slightly for the training to be equivalent.

Sailors who responded that simulation could replace underway training indicated that the experience of standing a watch in CIC was similar whether underway or in port. First, the same watch stations are manned, the same equipment is energized and operating, the lights are dark, radios crackle and the radar consoles are lighted. Second, they also indicated that the simulation equipment used for these multi-ship exercises is the same or better equipment than they use at sea, therefore the training is no better or worse than the underway training.

Finally, the chiefs interviewed indicated that the number of scenarios run was higher than the number of events that could be run at sea. The coordination issues associated with multiple ships participating in multiple scenarios would be difficult to emulate at sea while multiple scenarios could be run in a single day in port. This is important because these experienced leaders confirm that simulated training events can provide more training events, given limited training opportunities

Furthermore, while the response was equal across ranks, the number of people on the training team who responded that simulated training in port could replace some at sea training was greater than the number of similar responses from non-training team members. Sixty three percent of training team members responded that they strongly agreed that simulation is a suitable alternative to thirty-eight percent for non-training team members. This may indicate that the training experts believe that simulation is a good substitute to underway training. Regression analysis also indicates that non-CSTT members were less likely than training team members to believe in simulated trainings abilities. [Appendix Q.]

The follow up question provided a slight area of concern as seventy percent of respondents indicated that the scenario met their expectations but only twenty-eight percent strongly agreed and twenty eight percent disagreed. Interviews indicated that negative comments generally were due to high expectations. The sailors who were most disappointed were the sailors with the highest expectation.

Regression Analysis Regression analysis provided some insight into factors that cause an exercise to fail to meet expectations. The data indicates that the exercise met expectations if it provided realistic simulations at the operator's watch station and whether the trainer helped the operator learn to perform his duties better regarding Maritime Interception Operations (MIO). In other words, the training environment had to be realistic at his station and the trainer had to help him understand his duties in the primary mission area for the trainer, MIO. Stated another way, the training command must concentrate on providing realistic simulations to the operator that force him to learn the primary warfare duties he must fulfill during his deployment. [Appendix R]

Overall, a regression analysis indicates that sailors who believed that the training event used realistic simulations on their equipment and that the trainer met their expectations, also believed that simulation training can be a suitable replacement for underway training, at a 95% level of significance. This is not surprising, but if the fleet commander and the training command want to use simulation as a supplement or alternative to underway training they must ensure that the simulations used are realistic and that the scenario meets expectations. [Appendix O]

Additionally, the regression data indicates that how well the trainer taught MIO and air warfare tactics was a direct indicator of how sailors believed simulation could supplement and replace underway training. Since this event was a MEF team trainer, Air Warfare and MIO tactics were the primary training objectives. The ability of the training command to teach these objectives indicates whether the trainer will be successful. If the trainer was successful, then sailors believed simulation could be used to replace underway training. The lesson is to ensure that simulated scenarios offer realistic training scenarios in the warfare areas on which the simulated exercise focuses. [Appendix O]

Finally, the surveys indicate that sailors believed that learning to operate in a multi-ship environment was critical to the suitability of simulated training. The ability to communicate and operate among a variety of ships provided excellent experience prior to underway operations. Training commands should use this information and continue to create scenarios that force ships to coordinate and report to each other. [Appendix O]

(8) Potential Reduction in Administrative Time. Question twenty-four asked if standardized training scenarios run by a training command would reduce the amount of work for a ship in the IDTC. Over ninety percent of respondents indicated that they believe that the workload of training teams can be reduced by participating in more standardized distributed training scenarios. The strongest responses came from training team members who would actually benefit the most from having an outside command, such as FCTCPAC or Afloat Training Group (ATG) conduct these exercises.

After interviewing respondents, this was deemed a leading question. Of course, trainees want outside commands to take the burden of creating and running scenarios and, yes, standard scenarios are useful. However, the question did not ask whether these training events saved time. One Chief and Petty Officer involved in coordinating the scenario on board one of the two ships responded that the event did save time and did provide a reliable product. Time savings equaled both time saved prior to the exercise and time saved during the exercise.

Manpower savings during the exercise were achieved by reducing the number of Combat Systems Training Team members required to run the exercise. Normally, five to six people are required to run the simulation, monitor the timeline, cue watchstanders and respond to communications. While the number of evaluators remained the same, the number of onboard personnel required to run the scenario was reduced to two or three people. Training team members on both ships reported these savings through all three days of scenarios.

Prior to the exercise, FCTCPAC coordinated and issued all coordination messages and several OPTASK's associated with the control of the exercise. People from both ships indicated that there was a timesaving by combat systems division personnel because FCTCPAC wrote all messages, but these individuals had difficulty accounting for the number of hours saved. Several people interviewed indicated an approximate savings of five to ten hours writing and sending messages.

B. SUMMARY OF FINDINGS

The results of these surveys indicate that simulated training on the ship is a valuable tool that should be considered when preparing a task force or task unit for deployment. Though the training techniques and the simulations are not perfect they provide a valuable source of training for the operator. The survey results lead the analyst to this conclusion for several reasons.

- First, respondents indicate that the overall training received through simulation was realistic. The scenarios reflect current threats and provide challenges that push the sailor to learn. In addition, the simulations provide good operator training, but current shortfalls exist and should be improved by continuing to install the latest simulation hardware and software on ships.

- Second, multi-ship scenarios provide sailors an opportunity to learn to coordinate and operate as a team. Responses indicated that sailors benefited from being forced to apply OPTASKS, communicate and coordinate with ships of their MEF. The ability to learn and gain experience in multi-ship operations prior to underway exercises was extremely valuable.
- Third, in order to receive the greatest training value, scenarios should aim to teach sailors how to apply warfare area tactics. In this MEF team trainer, Surface, Air Warfare and MIO were the most important training objectives. How well the exercise was organized and designed to challenge the operator in these warfare areas was the leading indicator in the value of the training. Additionally, these scenarios should continue to utilize the command and control structure the ship will use while deployed. Sailors found that the communications infrastructure helped them learn reporting procedures and provided significant benefit.
- Fourth, the ability to train on consoles that the operator will use when deployed is more valuable than training on simulated consoles. Distributed training is more beneficial than mockup training, and is equivalent to underway training in many respects.
- Fifth, a majority of sailors believe that distributed simulation training can be a suitable replacement for underway training. Some sailors want to wait until the simulations improve before passing final judgment, but a major portion of the sample indicated that simulation, in its current state, provides adequate training as a substitute for underway training.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. THE COST OF CONDUCTING WEST COAST DISTRIBUTED SIMULATION NETWORK COMBAT SYSTEMS TRAINING

The benefits of using the West Coast Distributed Simulation Network are not achieved without a cost to the Navy. The analysis in the previous chapter indicates that distributed simulation training provides effective training to west coast combat systems sailors. Since simulated training has been shown to fit the needs of sailors, this thesis must now analyze the cost of conducting this training to evaluate whether distributed multi-ship training is cost effective.

An extensive infrastructure is required to properly script, run and distribute the simulated scenarios to ships in these homeports. Navy owned phone lines, training systems, communication equipment, and manpower are used to train individuals on ships in simulated exercises. The use of these assets involves a cost to the Navy because the funds required to conduct this training will be taken from those normally used for ship operations, maintenance or other equally important uses.

This thesis will address both the recurring costs of running and maintaining the WCDSN each year and the fixed infrastructure costs of establishing the network. Variable costs for each simulated exercise are important because the value to the fleet of conducting simulated training must be greater than the cost of conducting each event. Additionally, the benefit of each training exercise must be great enough to overcome the cost of maintaining the infrastructure required to support the training. In other words, the total benefit must exceed the costs of 1) the exercise and 2) the infrastructure.

Cost data were taken from numerous sources including maintenance records and manning documents at FCTCPAC, San Diego, from PMS 430 data sources and other contract information.

For all costs the assumption was made that six exercises were conducted in 2001 and six exercises in FY 2002 can potentially be conducted using the distributed simulation network. These estimates are derived from scheduled deployments of west coast ARG's, MEF's and Battle Groups during these years. Since these ships deploy on a notional two year cycle these exercise numbers were used to estimate the potential number of exercises that could be run in 2003 through 2005.

Additionally, the cost estimates included the location of the ships deployed during these years in determining which homeport sites had to be supported for which exercise. As a result the ship schedules used for estimating costs should be realistic although variances will occur due to ship schedule changes and the potential rotation of ships from the west coast to Japan. Current system installation schedules were also used to determine the cost of installing the systems on the west coast ships. These schedules are subject to change but should reflect a reasonable estimate of the trainer system installation costs during the next four years.

Another important note is that not all costs are attributed to line items in the CINCPACFLT or Third Fleet budgets. This chapter will categorize and quantify the cost of conducting these exercises in a meaningful way that illustrates what resources throughout the Navy are required to conduct multi-ship simulated exercises. Several different commands including CINCPACFLT, Third Fleet, NAVSEA, and CNET pay for elements of the WCDSN and funding from each of these sources is required to maintain and operate the training network.

A. RECURRING AND VARIABLE COSTS

This thesis will first address WCDSN recurring and variable costs. Phone line, TACDEW maintenance, MUTTS maintenance, and software update costs occur in a regular, predicable pattern and are not variable costs in the sense that they change related to the amount of training conducted. These costs cannot be considered fixed costs either as they vary depending on whether training is held or not. Most of these costs could be eliminated if simulated exercises were discontinued. This thesis considers these as recurring costs.

The primary variable cost associated with the training network is the manpower costs associated with conducting a trainer. The manpower costs to create exercise scenarios, operate BFTT and TACDEW for an exercise, and coordinate training onboard the ship vary with each exercise. These costs vary by type of training, location of the units participating in the exercise and by the number of units participating in an exercise.

Understanding the cost drivers for these variable costs is important when trying to understand how to reduce costs in the future. In the following sections, this thesis will discuss each of these recurring and variable costs in detail and include them in the final comparison of system costs and benefits.

1. ATM and T-1 Phone Line Costs

Land telephone lines are used to transmit scenario data from the exercise control center at FCTCPAC, San Diego, to ships in each of the homeports. Without the data communications path, no ship would receive the radio communications and scenario data that enable ships to participate from remote locations.

The decision has been made to rely on ground-based communication paths because of their reliability. Satellite radio and LINK communications have been used to transmit exercise scenario data but this transmission method has three limiting factors. First, not all ships are satellite link capable. Second, satellite transmission has proven to be slower and can degrade the speed of track updates. Finally, BFTT exercise data cannot yet be transmitted from ship to ship by satellite communications.

The WCDSN uses Asynchronous Transfer Mode networks and hardwired T-1 phone lines to transfer data in the ground-based infrastructure. Both transmission media offer bandwidth consisting of a digital signal that provides 1.544 megabits per second connectivity to ships in each port. This bandwidth allows FCTCPAC to transmit a combination of up to twenty-four LINK, BFTT and radio communications channels to each homeport. Unlike a home computer modem, a T-1 line requires a Channel Service Unit/Data Service Unit (CSU/DSU) to translate the digital data so that the training system and other equipment at each site can interpret the data. This CSU/DSU acts as the digital modem for the T-1 phone line.

FCTCPAC leases the hardwire lines from private phone companies and bandwidth on the San Diego to Hawaii ATM and the Pacific Northwest Metropolitan Area Network from Navy communication commands. Line maintenance and maintenance on the CSU/DSU are part of the contract and are provided on an “as needed” basis.

Phone line lease contracts are one year in length and can be disconnected when training is not conducted for extended periods of time. Substantial costs are incurred disconnecting and re-establishing these phone lines. Reconnection charges are approximately equal to three month's rent on the phone line. The network has not been disconnected during the last two years to avoid large re-installation costs. This also enables continuous training to all west coast homeports with no additional T-1 phone line costs. The analysis in this thesis assumes that these phone lines will remain connected for future years and that the yearly cost of using those lines is allocated to each year of operation.

From	To		Monthly Cost	Yearly Cost	Funding Source
FCTCPAC	NAVSTA SANDIEGO	Area Network	$600.00	$7,200.00	PMS 430
FCTCPAC	NAVSTA BREMERTON	T-1 Line	$2,939.52	$35,274.24	FCTCPAC
FCTCPAC	NORTH ISLAND	T-1 Line	$431.01	$5,172.12	CNET
FCTCPAC	SUBMARINE TRAINING FACILITY SAN DIEGO	T-1 Line	$350.00	$4,200.00	CNET
NORTH ISLAND	MAKALAPA (ATM)	ATM Network	$1,400.00	$16,800.00	CNET
MAKALAPA (ATM)	ATG MIDPAC	T-1 Line	$439.01	$5,268.12	CNET
ATG MIDPAC	NAVSTA PEARL HARBOR	T-1 Line	$433.33	$5,199.96	FCTCPAC
ATG MIDPAC	NAVAL SUBMARINE TRAINING CENTER	T-1 Line	$438.99	$5,267.88	FCTCPAC
NAVSTA BREMERTON	PACIFIC NORTHWEST MAN	Metropolitan Area Network	$833.33	$9,999.96	FCTCPAC
			$7,865.19	**$94,382.28**	

Table 2. Annual West Coast Distributed Network Line Costs

The costs associated with the West Coast T-1 and ATM network as presently configured are listed in Table 2. This network provides sufficient bandwidth to allow large amounts of encrypted exercise and communications data to reach the ships in real time. Future bandwidth the Navy is installing between homeports such as Base Level Information Infrastructure (BLII) and Defense Information Infrastructure (DII) and other possible resources may provide potential future savings.

2. TACDEW Maintenance

Because TACDEW is still the primary exercise control system, TACDEW maintenance is a key measurement of the ability of the trainer to meet the needs of the fleet. If this system is not properly maintained, FCTCPAC's ability to distribute combat systems' scenarios to ships will be degraded. Lack of proper maintenance will lead to critical system failures during exercise scenarios.

CUBIC Corporation has been hired to conduct maintenance on TACDEW through the Contractor Operation and Maintenance of Simulators (COMS) contract that supports all simulation systems on the west coast. Six maintenance personnel maintain, update software and repair the TACDEW critical hardware systems. CUBIC must buy or repair parts to keep the system operating at stringent system availability levels. Also, the company must provide maintenance support during all training events and must promptly respond to equipment problems that occur during a training exercise.

Not all TACDEW contract costs should be attributed to the WCDSN, because the primary purpose of TACDEW is to train operators in combat systems mockups at FCTCPAC. Training in these mockups support the classes CNET requires FCTCPAC to teach including MK-23 TAS operators training, Air Intercept Controller training, Anti-Submarine Tactical Air Controller (ASTAC) training, Amphibious Boat Controller training, and other classes. To appropriately account for the TACDEW maintenance costs associated with the WCDSN the maintenance contract costs must be allocated using cost drivers. The first question to find these drivers is: which of the five TACDEW subsystems is used during a multi-ship exercise? WCDSN distributed simulation scenarios use only the EGCS and EVCS systems. EGCS is used to provide the track data and EVCS is used to allow training center controllers to talk to shipboard operators by radio. Because only these two systems are used, only the costs associated with these systems should be allocated to the WCDSN. The total cost to maintain EVCS and EGCS was located in the West Coast COMS contract with Cubic for TACDEW maintenance.

The second question asked to find the cost drivers is how often is the trainer used year-round for multi-ship simulated exercises scenarios? The total maintenance costs for EVCS and EGCS must be allocated based on the percentage of annual training time that is used for multi-ship exercises. CUBIC is contracted to maintain the system for 52 weeks a year plus any overtime required for exercise support. [Reference 21] The system is used every week for local (inside the building) training at FCTCPAC and is only used an average of 7 weeks per year for distributed, multi-ship exercises. Accordingly, this thesis allocates 7/52 of the cost of maintaining the EVCS and EGCS systems to the WCDSN. EVCS and EGCS costs in Table 3 are taken from the TACDEW maintenance contract with CUBIC and are the network share is calculated using the percentage of annual training time for multi-ship exercises.

WESTCOAST COMS CONTRACT at FCTCPAC, SAN DIEGO						
System		Monthly	Annual	Number of Exercise Weeks	Weeks Supported	Network Share
Environmental Generation and Control System (EGCS) 20F15A/9						
	Maintenance	$ 6,121	$ 73,452	7	52	$ 9,888
	Supply Support	$ 99	$ 1,188	7	52	$ 160
External Voice Communication System (EVCS) 20F15A/11						
	Maintenance	$ 4,246	$ 50,952	7	52	$ 6,859
	Supply Support	$ 217	$ 2,604	7	52	$ 351
Total Scenario Generation Maintenance Cost Note: 6 people, 37.5 hours per week, 52 weeks per year						$ 17,257

Table 3. TACDEW Maintenance Support Contract Per Year

3. BFTT Maintenance and Software Update Costs

Maintaining BFTT training systems on both the shore and ships is an important part of ensuring that ships are capable of receiving the highest quality training available and that the simulation system is available when needed. Naval Sea Systems Command, NAVSEA, PMS 430, provides funds to support both the shore and ship BFTT systems, periodically updates software and conducts maintenance technical assists to upkeep the training systems. For example, PMS 430 updates track databases, entity characteristics and parameters to current threats. The cost of conducting this upkeep is part of the cost of the WCDSN.

PMS 430 budgeted approximately $380 thousand for maintenance and software support in FY 2001. [Reference 23] This supports all BFTT capable ships in the U.S. Navy and only a portion should be allocated to the WCDSN. Neither the maintenance nor the software support costs are budgeted per specific ship. As a result, these costs are allocated proportionally based on the number of BFTT ships on the west coast.

The driver for these maintenance costs is the number of ships in the Navy. The money budgeted to support installed BFTT systems should be allocated to all ships with BFTT installed. The number of ships on the West Coast with BFTT installed times the allocated cost per BFFT ship in the Navy will estimate the maintenance and software costs allocated to the WCDSN. The percentage of BFFT ships on the west coast is used to determine the percentage of software and maintenance costs allocated to the WCDSN. This calculation assigns only the costs associated with west coast BFTT installations to the cost of the WCDSN.

Table 4 illustrates the budgeted fiscal year 2001 maintenance and software costs for BFTT ships on the west coast. Navy-wide maintenance, parts supply, Battle Group and software costs are totaled and multiplied by the percentage of BFTT ships that participate in WCDSN exercises. In FY01 187 BFTT, BEWT and TSSS units were installed on Navy ships. Fifty-one of these installations were on west coast BFTT ships. This amounts to 27.2 percent of Navy-wide BFTT installations. This percentage is multiplied by the total maintenance cost to derive the estimated software and maintenance costs attributed to the WCDSN.

BFTT Ship Software and Maintenance Costs	
SYSTEM MAINTENANCE (40+ SHIPS)	$ 219,000
SUPPLY SUPPORT, LOGISTICS	175,000
PROGRAM TECHNICAL SUPPORT	243,000
BATTLE GROUP SUPPORT	140,000
SOFTWARE BUILD 3.0.2	140,000
SOFTWARE BUILD 3.0.3	19,500
Total	$ 936,500
Percentage of BFTT Ships on West Coast	0.272727
Total Software and Maintenance Allotted to West Coast Ships	$ 255,409

Table 4. BFTT Software and Maintenance Costs Per Year

4. Maintenance of MUTTS Radios

One of the primary costs of the WCDSN is the cost of maintaining the MUTTS sites at each homeport. These MUTTS sites contain the timeplex equipment, radios, and antennae needed to broadcast simulated LINK-11 and radio communications for each exercise. The equipment acts as relay stations that give ships in multiple homeports the ability to communicate with each other, using their own radios.

These sites use Navy issued antennae, radios, circuit cards to key these radios, and timeplex equipment, which is maintained by FCTCPAC technicians. FCTCPAC maintenance technicians travel to each participating homeport to conduct maintenance on MUTTS equipment. The San Diego radios are housed at FCTCPAC so no traveling is required. FCTCPAC, funded by CNET, budgets and pays for these technicians and the spare parts needed to repair the equipment at each site.

This thesis accounts for MUTTS maintenance costs using historical FCTCPAC databases. Over the last three years FCTCPAC has spent approximately $25 thousand per year maintaining the MUTTS radios and other equipment at these sites. In addition, FCTCPAC has spent approximately $10 thousand to maintain timeplex equipment at all sites. The cost for each individual MUTTS site and the timeplex equipment is illustrated in Table 5.

The driver for maintenance costs is the percentage of time the equipment is used for multi-ship exercises. One hundred percent of the MUTTS costs associated with the Bremerton, Everett, and Pearl Harbor sites are allocated to the WCDSN because these sites solely support multi-ship training exercises. FCTCPAC MUTTS equipment is used to support other Third Fleet training requirements such as JTFEX, COMPTUEX, ARGCERT, and the Fleet Battle Experiments. From previous FCTCPAC training schedules, approximately 60% of San Diego MUTTS usage is due to WCDSN exercises. [Reference 24] Thus, the allocated cost of maintaining the radios at FCTCPAC is 60% of total MUTTS maintenance costs. The entire cost of maintaining timeplex equipment is allocated to the WCDSN because the equipment is only used for multi-ship exercises.

MUTTS MAINTENANCE(Per Year)	Maintenance Cost	% Applied to Inport Exercise	Total Cost
WSC-3 and Associated Equipment			
Everett & Bremerton	$ 7,000	1.00	$ 7,000
Pearl Harbor	$ 6,000	1.00	$ 6,000
FCTCPAC	$ 12,000	0.60	$ 7,200
Timeplex and other equipment(all sites)	$ 10,000	1	$ 10,000
Total MUTTS Maintenance Costs			**$ 30,200**

Table 5. MUTTS Maintenance Costs

5. Manpower Costs

The largest portion of the variable cost of conducting these WCDSN exercises is the manpower costs due to exercise preparation, scripting, and control. FCTCPAC and other training commands dedicate substantial numbers of people to create and run the exercises. The Team Training Department at FCTCPAC consists of several divisions of people with approximately thirty people in total. These people are dedicated to creating and running the scenarios for multi-ship exercise and devising new and innovative additions to the training.

The manpower requirements associated with running these exercises follow the same pattern that the rest of the Navy faces. The manpower costs of a system are frequently larger than the cost of the system itself. Similarly, the largest portion of the WCDSN system cost is the manpower cost to maintain and operate the system. Forty-six percent of WCDSN costs are due to the manpower required to run the network. Consequently, a key issue in the future will be to lower the system maintenance and operator manpower costs.

The people who maintain and operate the WCDSN represent an opportunity cost to the Navy as their time could be used to man ships at sea, to train other classes at FCTCPAC, or other equally important activities. This thesis estimates the number of staff hours required to perform each of the training functions FCTCPAC provides during WCDSN exercises. Each estimate was made by reviewing watch bills and conducting interviews with FCTCPAC staff to estimate: 1) how many people are required to run an exercise, 2) their approximate pay grade, and 3) the amount of time each person is works on each exercise. The per-exercise manpower requirements are added together to determine total manpower for fiscal year 2001 exercises. Manpower costs are based on the typical number of hours each individual works on WCDSN exercises.

The cost of manpower is estimated using the daily wage rate for the manpower required to run each exercise, by rank, from the 2001 Military Composite Standard Pay and Reimbursement Rates for the Department of the Navy. [Reference 22] This thesis charges each person's time on an hourly basis and multiplies the wage rate by the manpower requirements to estimate the exercise cost attributed to the WCDSN.

Table 6 lists the major manpower requirements for WCDSN exercises. Each category's manpower costs will be estimated using the manhours and wage rates discussed above.

Manpower Costs	
Exercise Administration	Ship Liaison
Scenario Generation	MUTTS Technician
Exercise Control	BFTT Shipboard Operator Training
Submarine Trainer Control Device	Training Initial MUTTS Technicians

Table 6. Manpower Cost Categories

a. Exercise Administration Costs

FCTCPAC staff writes all pre-exercise messages and meets with the Battle Group warfare commanders to solicit input about the conduct of the exercise then creates the communication plan and script for the exercise. Although the administrative time spent by the FCTCPAC training department is the smallest portion of the exercise manning cost, this service eliminates some shipboard administrative time. The cost to FCTCPAC of providing this service is best estimated by the man-hours FCTCPAC training staff must spend performing administrative work. For each exercise, one FCTCPAC staff member, usually an E-6 writes and transmits to participants all pre-exercise messages, communications plans, LINK orders, and other and messages and the E-6 wage rate is used to determine manhour costs. Information from interviews indicates this process takes thirty to thirty five hours per exercise.

Table 7 shows the estimated administrative manpower costs per exercise based on four days work for an E-6. This cost does not vary with the number of ships in an exercise and is similar for every exercise. These administrative costs vary by exercise and annual costs will differ as the number of exercises run increases or decreases.

Training Manpower	Rank	Amount	Ships	Days	Daily Rate	Total Per Exercise
ADMININISTRATIVE COST Pre-Ex Coordination	E-6	1	N/A	4	$250	**$1000**

Table 7. Administrative Costs Incurred at FCTCPAC, San Diego Per Exercise

b. Scenario Generation Costs

FCTCPAC staff scripts and enters all scenarios currently used during west coast multi-ship exercises into TACDEW or BFTT. First, the FCTCPAC staff will gather information for the scenarios in TACDEW or BFTT. The Battle Group or task force commanders specify the exercise requirements and specific mission area training needed. Next, FCTCPAC surveys recently deployed ships and consults with intelligence and other training commands to create realistic scenarios that reflect current fleet experiences and meet the training needs of the Battle Group Commander.

One FCTCPAC training division of four sailors takes Battle Group Commander inputs and creates the scenarios in the training system to be used for an event

(BFTT or TACDEW). These scenarios are approved for task force training by the warfare commander and are saved for future use and reference.

The evaluation of the cost effectiveness of simulated training requires that this thesis account for the time these training division sailors spend creating the scenario. The best estimation of the costs is the value of the man-hours spent creating these scenarios using the Navy daily rate for each sailor. Scenario generation man-hour estimates for 2001 are based on interviews with scenario generation division heads and scenario generation man-hour logbooks. [Reference 25]

Table 8 estimates the scenario creation costs associated with each exercise. One E-6 spends an average of two days as the coordinator gathering information from different sources and creating overall exercise objectives and events. Two E-5's and an E-4 develop the scenario and input tracks and events into BFTT or TACDEW. Developers spend approximately ten days per exercise and the people who manually input exercise data into the training systems spend approximately twelve days per exercise.

These costs are per exercise estimates based on historical data and annual costs will vary as the number of exercises in a year increases or decreases. Scenario scripting requirements will also vary depending on the complexity of each exercise. This variance is too difficult to estimate, and this is the reason that an average of previous exercises was used to estimate costs.

Training Manpower	Rank	Amount	Ships	Days	Daily Rate	Total Per Exercise
SCENARIO GENERATION(Writing)						
Coordinator	E-6	1	N/A	2	$250	$500
Developer	E-5	1	N/A	10	$213	$2,130
Input	E-5	1	N/A	12	$213	$2,556
Input	E-4	1	N/A	12	$176	$2,112
Total Genertion Cost						**$7,298**

Table 8. Scenario Generation Manpower Costs Per Exercise

c. Exercise Control Manpower Cost

Sailors from the FCTCPAC training department staff the exercise control center during every Battle Group trainer. They monitor the exercise, maintain the communications network, and evaluate participating ships' performance. The FCTCPAC staff interacts with sailors on the ship by controlling the entities that shipboard operators see on their radar repeaters. In essence, the staff fly the aircraft, control the surface ships, respond to queries by shipboard operators and act as the moving force behind the scenarios. In addition, the training staff makes sure that the network is operating efficiently and that all ships receive LINK through the network. It is their interaction which makes the scenarios realistic and responsive to the training needs of the shipboard sailor. A FCTCPAC trainer replaces the Battle Group staffs and ship personnel needed to conduct the exercise. FCTCPAC's ability to evaluate and debrief ship crews is also an important benefit of their work.

FCTCPAC is currently the only command capable of coordinating such an expansive simulated exercise on the west coast. The considerable manpower resources are necessary because current training simulators still require people to operate entities within the exercise and alter scripts. This manning requirement will be necessary until BFTT or TACDEW can be updated with capabilities such as semi-automated forces or intelligent entities that will maneuver themselves through artificial intelligence. These improvements in technology should be available in the next few years.

Until training system operators are no longer needed, the FCTCPAC exercise control operators are another opportunity cost to the Navy. Their time is an allocated cost of conducting multi-ship coordinated exercises. Estimates for manning requirements were created by reviewing previous watch bills and through supporting interviews with senior enlisted leaders in the FCTCPAC exercise control division. [Reference 25]

Battle Group, ARG and MEF multi-ship exercise manning requirements at FCTCPAC vary only slightly as the same training stations are manned for each type of exercise. The rank of individuals varies slightly by exercise and annual costs can best be estimated by multiplying the per exercise costs by the number of exercises conducted in a given year. The exercise manpower cost estimate is multiplied by the number of exercises run in a year to approximate annual costs.

Table 9 estimates the typical watch stations used during an exercise and the associated manning cost, by rank, for a Battle Group exercise. Most individuals work only the two days of the exercise. Several individuals, including the exercise coordinator, supervisor, and LINK supervisor, typically work three additional days to conduct connectivity and communications checks with participating ships. This investment ensures that ships systems are properly aligned for training and helps identify equipment problems that may impact a WCDSN exercise.

Training Manpower	Rank	Amount	Ships	Days Worked	Daily Rate		Total Per Exercise
EXERCISE							
EXERCISE COORDINATOR	0-3	1	N/A	5	382	$	1,908
EXERCISE SUPERVISOR	E-7	1	N/A	5	287	$	1,437
AIRTRAC	E-5	1	N/A	2	213	$	426
CAPSUP	E-6	1	N/A	2	250	$	499
CAP	E-5	3	N/A	2	213	$	1,279
SUPCAP	E-5	2	N/A	2	213	$	853
BRIDGE TO BRIDGE OPERATOR	E-4	3	N/A	2	176	$	1,056
ID COORDINATOR	E-5	1	N/A	2	213	$	426
LINK SUP	E-5	1	N/A	5	213	$	1,066
MAD/IAD	E-5	1	N/A	2	213	$	426
Scenario Center Cost						$	7,232

Table 9. Exercise Control Manpower Cost Per Exercise

d. Submarine Trainer Control Device Manpower Cost

Not all WCDSN multi-ship training exercises include undersea warfare (USW) as one of the warfare missions evaluated. Amphibious Ready Groups do not contain sonar capable ships and their exercises do not utilize the equipment and manpower needed to support this training. However, Battle Groups and Middle East Force deployers do conduct USW training in their multi-ship exercises. These exercises require additional equipment and training staff to run the submarine trainer control devices that stimulate surface combatant sonar systems through an onboard trainer (OBT).

Fleet Anti-submarine Warfare Training Center (Fleet ASW) in San Diego provides the expertise and manning required to set up and operate the USW training devices. The Trainer Control Device (TCD), located at FCTCPAC, is connected to BFTT and TACDEW and uses the scenario information generated on these two systems to send simulation information to the sonar suites on the participating surface combatants. Normally, two senior Fleet ASW petty officers, an E-6 supervisor and an E-5 operator, run the Trainer Control Device (TCD) each exercise day. These senior petty officers send the USW scenario to the ships, coordinate training and control scenario subsurface contacts. The number of operators is constant regardless of the number of ships participating in exercises and they are needed for the three exercise days.

In addition to manning the TCD, Fleet ASW staff connects the wires that allow a ship's OBT to communicate with the TCD at FCTCPAC. The number of ship OBTs varies with the number of sonar-equipped ships in an exercise. Each sonar-equipped ship requires an operator who ensures that the sonar suite is properly stimulated by the TCD and troubleshoots any equipment problems. Thus, the number of OBT operators varies by the number of sonar-equipped ships in an exercise. The shipboard operators are required to debug and set up the equipment on the ships for approximately two days prior to the exercise, raising the number of days that are used to five.

Because Fleet ASW staff is required for multi-ship in port exercises, this thesis accounts for the cost of their time and Table 10 illustrates the process used to estimate an exercise's USW training costs. Each WCDSN exercise's cost includes the cost of the OBT operator multiplied by the number of ships in the exercise plus the cost of the TCD operators. This total cost is only applied to WCDSN exercises that include sonar-equipped ships.

Training Manpower Per Under Sea Warfare	Rank	Amount	Number of Ships	Days	Daily Rate	Total Per Exercise
Submarine TCD Operators						
Submarine TCD Supervisor	E-6	1		3	$250	$750
TCD Operator	E-5	1		3	$213	$639
Ship TCD Operator	E-5 PER SHIP	1		5	$176	$880
Total						**$2,269**

Table 10. Anti-Submarine Warfare Trainer Control Device Manning Costs Per Exercise

e. Ship Liaison Officer Cost

FCTCPAC sends liaison officers to participating ships to facilitate multi-ship exercises. These officers provide training system expertise to ensure that shipboard systems are properly configured to receive exercise training scenarios. They also help exercise control operators at FCTCPAC troubleshoot network faults and provide amplifying information and disclosures that will help the ship's crew understand the scenario and some of the "trainerisms" or unrealistic simulations. Ship liaisons are a vital link between the training command and the ship and are needed to ensure that the training is responsive to the needs of the ships and that equipment problems within the network do not degrade training. These officers correct the problems and maintain smooth exercise flow.

Table 11 illustrates an example of the manpower costs for an exercise that includes three ships from Everett, Pearl Harbor and Bremerton. Each exercise will have different ship liaison officer costs depending on the number and location of ships participating. The cost of travel and the officers' time is allocated to the WCDSN. This thesis estimates the amount of travel based on fiscal year 2001 and 2002 ship schedules and includes travel costs for every exercise that includes ships in a remote homeports.

Ship Liaison Manpower and Travel Cost	Rank	Amount	Number of Ships	Days	Daily Rate	Total Per Exercise
SHIP LIASON OFFICER	O-3 PER SHIP	3		5	$381	$5,715
Travel for out of area						
Bremerton		1	Variable			900
Everett		1	Variable			900
Hawaii		1	Variable			1400
Total Liaison Officer Cost						$8,915

Table 11. Ship Liaison Manpower and Travel Cost

f. MUTTS Technician Cost

Maintaining the WCDSN infrastructure is a significant cost of conducting training using the network. Each MUTTS station houses numerous radios and associated timeplex equipment needed to connect these radios together. Currently, FCTCPAC Electronic Technicians conduct routine annual maintenance on the radios at each site to ensure that equipment is functioning properly needed for training. [Reference 26]

Additionally, these same FCTCPAC Electronic Technicians provide the operating and the maintenance personnel required at MUTTS stations during each exercise. Prior to each exercise these technicians tune radios and dial in frequencies used for that exercise. This technician manning also provides a maintenance capability in the event that equipment problems occur.

Electronic Technicians are required at FCTCPAC for all training exercises including exercises that do not include San Diego area ships. These technicians operate and maintain the local San Diego MUTTS equipment and are needed to ensure that the network distribution node equipment is working properly.

FCTCPAC has a division of approximately thirty Electronic Technicians who maintain network communication equipment at FCTPAC and are also sent to the remote homeports for each exercise. The WCDSN cost analysis must include both the cost of travel to each homeport in an exercise and the daily wage rate for the time each petty officer spends per exercise.

Table 12 illustrates the MUTTS technician cost for an exercise with units in Hawaii, Bremerton, San Diego and Everett. A review of previous exercise manning documents indicates that two technicians are sent to each homeport, one E-5 and one E-4. Each individual is in the homeport for three days of testing plus the two exercise days. Their time is accounted for using the daily wage rate. Travel costs to the homeport from San Diego are also included. Theses MUTTS technician costs vary by the homeports of ships in an exercise and technician costs are not included in an exercise's cost if the exercise does not include ships in a specific homeport.

The manhours per event at FCTCPAC estimates the cost of technicians' time needed to maintain network distribution node equipment and support the WCDSN exercise. The technicians are needed for two days of testing and troubleshooting prior to an exercise plus the two exercise days. FCTCPAC manpower costs also include administrative time spent by one senior petty officer sending radio frequency messages. This individual works with the team training petty officer to ensure that all tasking messages are written for the Battle Group staff. The rank for each individual used in the cost estimation was taken from a previous FCTCPAC watchbill.

FCTCPAC MUTTS Technician Costs Per Exercise	Travel Each Person	Rank	# of People	Days	Daily Rate	Total
Hawaii per Exercise including Hawaii Units						
5 DAYS Manpower Technician for MUTTS		E-5	1	5	$213	$1,066
5 DAYS Manpower Technician for MUTTS		E-4	1	5	$176	$880
Travel	1400		2			$2,800
Total per Event in Hawaii						**$4,746**
PACNORWEST per Exercise including:						
Bremerton Units						
5 DAYS Manpower Technician for MUTTS		E-5	1	5	$213	$1,066
5 DAYS Manpower Technician for MUTTS		E-4	1	5	$176	$880
Travel	900		2			$1,800
Total per Event in Bremerton						**$3,746**
Everett Units						
5 DAYS Manpower Technician for MUTTS		E-5	1	5	$213	$1,066
5 DAYS Manpower Technician for MUTTS		E-4	1	5	$176	$880
Travel	900		2			$1,800
Total per Event In Everett						**$3,746**
Manhours Per Event at FCTCPAC						
0700-1500/4 DAYS						
E-7 (1 EA)/4 DAYS		E-7	1	4	$287	$1,149
E-6 (2 EA)/4 DAYS		E-6	2	4	$250	$1,998
E-5 (2 EA)/4 DAYS		E-5	2	4	$213	$1,706
E-4 (2 EA)/4 DAYS		E-4	2	4	$176	$1,408
E-3 (3 EA)/4 DAYS		E-3	3	4	$148	$1,773
OPTASK ADMIN		E-6	1	5	$250	$1,249
Total Technician Cost per Event						**$9,282**
Total Exercise Cost						**$21,520.27**

Table 12. Example of FCTCPAC MUTTS Technician Maintenance and Travel Costs

g. BFTT Shipboard Operator Training Cost

The next WCDSN manpower cost is the cost of training personnel who must operate the BFTT system on their ships. No BFTT operator school exists. Instead, Operations Specialists (OS) are trained during the OS "C" school conducted at FCTCPAC. Senior OS's attend one hour of classroom training and one hour of lab practical work during the six week long course to familiarize the operators with the training network and to learn how to use the BFTT system as a stand alone trainer on their ship.

To estimate the cost of training these individuals, most of who are E-6's, this thesis used the daily rate times the number of students trained per year. The OS "C" school teaches approximately five classes of 24 students per year. The time these students spend in the classroom is the approximate cost associated with preparing west coast ships to train on the network. The number of students taught in FY 2001 was used to estimate the costs of conducting training for shipboard operators. The annual ship operator training costs are illustrated in table 13.

BFTT Shipboard Operator Training		
"C" School Students Per Year		120
Hours Per Student		2
Total Hours		240
Student Days (Hours/8)		30
E-6 Daily Rate	$	250
Total Estimated Cost Per Year	$	7,500

Table 13. Estimated Annual BFTT Shipboard Operator Training Cost

Not included in the analysis is a $559,000 cost PMS 430 budgeted to create a training curriculum. This one-time investment will be used to train sailors in future years. These costs should be attributed to future years as well as costs to update the curriculum.

h. Training Initial MUTTS Technicians

Operating, maintaining and repairing the timeplex equipment used in the MUTTS infrastructure is not a skill that is taught in Navy technical schools. Therefore, FCTCPAC sent technicians to commercial schools for proper training. These technicians learned to configure the network for training and ensure that the scenarios are transmitted from FCTCPAC to the homeport nodes successfully. The individuals who attended the school now train other technicians at FCTCPAC in on the job training. Since this cost of training is an investment for the life of the network this thesis capitalized the investment and allocated the cost over a five-year period that the training should be useful. Additional technicians may have to be sent to school again in several years, but this education cost is treated as a one time, initial training cost. Training was conducted in FY 2000 and the cost will be allocated over the next five years.

Table 14 illustrates the cost to send two chief petty officers to timeplex training, which lasted ten days. The cost of their time plus the $5,000 cost to send both technicians to school equals the estimated timeplex technician training cost allocated to the WCDSN.

Initial Timeplex Costs						
	School Cost Cost	Rank	Number of People	Days	Daily Rate	Total
Mutts Timeplex Training 2 Technicians	5000		2			10,000
Technician Time Cost		E-7	2	10	$ 287	5,746
Total						$ 15,746

Table 14. Initial Timeplex Technician Training Cost

B. ACCOUNTING FOR FIXED INFRASTRUCTURE COSTS

Fixed infrastructure costs are an important portion of the operating costs associated with the network. The WCDSN structure includes the simulation systems, the network and communication equipment used to connect the ships in a multi-port exercise. The components of this network are the capital assets the Navy uses to conduct multi-ship training. This thesis includes the depreciation cost of these assets over the useful life of the equipment. This section will estimate the costs of the following fixed infrastructure items: installation of PACNORWEST MUTTS van, BFTT installations, ATG MIDPAC antennae installation, and TCD installation. This section also discusses why TACDEW and submarine attack center installations were not included in the cost estimates.

1. Installation of PACNORWEST MUTTS Van

NAVSEA PMS 430 constructed a mobile trailer with the radio communications equipment needed to broadcast radio and link communications from FCTCPAC to ships home ported in Everett, Washington. No suitable permanent Everett location existed to house the equipment that allows ships to participate and communicate with ships in other homeports using UHF line of site communications. Satellite radio channels were insufficient to provide the command and control needed for multi-port training exercises.

This mobile training device was built and equipped in 1998, using government furnished equipment in addition to commercial hardware. Timeplex equipment connects the trailer's radios to the signals sent by FCTCPAC and translates them into signals that can be transmitted to the ships by the trailer's radios.

The installation of this equipment was completed in FY2000 when the trailer was moved to Naval Station Everett and connected to the network. The $1.5 million dollar cost of installing the van is depreciated over the useful life of the equipment, which is estimated to be 5 years. Table 15 illustrates the yearly depreciation cost allocated to the WCDSN.

PACNORWEST MUTTS TRAINING DEVICE	
Radios, Mobile Trailer, Couplers, Antenna, other equipment,	1,500,000
Transportation to Everett	15,000
	$ 1,515,000
Annual Depreciation over Five	$ 303,000

Table 15. Pacific Northwest MUTTS Installation Cost

2. Installation of ATGMIDPAC Antennae

In FY 2001, FCTCPAC sent technicians to ATG MIDPAC, the Pearl Harbor MUTTS site, to install new antennae to replace corroding antennae. The purpose of this upgrade was to ensure that the site will be usable and Pearl Harbor ships will be able to participate in multi-ship exercises for the next five years. The antennae, fasteners, cabling, and other parts cost approximately $150 thousand dollars. Table 16 shows this $150 thousand infrastructure cost depreciated over the expected useful life of the antennas. This analysis attributes these maintenance cost to the WCDSN.

ATG MIDPAC Antenna Install	
Equipment Cost	$ 150,000.00
Annual Depreciation over Five Years	$ 30,000.00

Table 16. ATG MIDPAC Antenna Installation Cost

3. BFTT System Installation Cost

The WCDSN is reliant in part on the BFTT systems installed on west coast ships. As more ships become BFTT capable, more scenarios will be broadcast from FCTCPAC using BFTT technology. NAVSEA, PMS 430, and Third Fleet are making a substantial investment installing this training system on west coast ships so that these systems can be used for individual training and in multi-ship in port exercises.

To account for the cost of these installations two factors must be considered; the depreciation period and the percentage that these assets are used for distributed training.

First, the cost of the installation is a significant investment in the training capability of a ship. These BFTT systems are long-lived assets that should be used, with upgrades to the software and hardware, for the life of the ship. BFTT installation costs should be depreciated over the life of the asset. Since this is a computer system, the depreciable life of the BFTT training system was set at 5 years, which is the normal practice for computer systems.

Second, the BFTT system is used primarily for single ship training even though its primary advantage is the ability to conduct multi-ship training. Since this system is used to conduct ship internal training during inspections and periods at sea, only the portion of costs associated with multi-ship training should be allocated to the WCDSN. From interviews with the West Coast Port Engineer and training officials at FCTCPAC it was determined that approximately sixty percent of BFTT system use is used for multi-ship training.

The BFTT installation schedule for the next five years was used to determine the number of WCDSN ships which will have BFTT installed each year. This installation cost was also broken down by BFTT installation cost, BEWT installation cost, and TSSS system installation costs. Because of changing ship schedules and the availability of each system to be installed the number of each system installations varies as by year. Therefore, the projected costs of installations by year were used as the basis for analysis. The next two sections discuss the allocation of BFTT installation costs.

a. FCTCPAC Cost

The BFTT system at FCTCPAC was installed at the end of 1997 at a cost of approximately $3.5 million and will end its five-year depreciable life in FY 2002. Until the follow on training system, Multi-Mission Team Trainer, is installed, BFTT provides the link to BFTT capable ships, the TCD, and to the submarine attack centers.

The system, with a five BFTT Operator Console (BOPC) configuration, was installed at FCTCPAC for the sole purpose of multi-ship training. Unlike TACDEW, the training system cannot be used to run the combat systems mockups at FCTCPAC. Therefore, the entire BFTT system installation cost is attributed to the cost of running the

WCDSN. Table 17 illustrates the FCTCPAC installation costs and the estimated annual depreciation cost based on the five-year depreciable life.

FCTCPAC		
BFTT Installation (5 BOPC's)	$	3,500,000
Annual Depreciation	$	700,000

Table 17. FCTCPAC BFTT Installation and Depreciation Costs

b. Shipboard BFTT, BEWT and TSSS Installation Cost

BFTT ship installations are increasing as the system continues to add functionality. The system will be the training platform of the near future and the investment in embedded trainers is a key cost of the training network. Again, NAVSEA, PMS 430 pays for the installation of these systems as a SHIPALT so the cost does not directly show up on the budget of the commands that benefit from its use. However, these Navy resources must be counted when evaluating the costs of conducting simulated training through the WCDSN. Currently, twenty ships on the west coast have BFTT installed and 40 ships are scheduled to have BFTT or BEWT installed by 2003.

Each BFTT installation is different because the equipment on each class of ship is different. Larger platforms have more combat systems and more operators to train. These ships receive more operators' consoles. Some ships have more radars that must be stimulated. To provide the training contacts to the operator, these ships receive more radar stimulation units (TSSS).

Full BFTT system capability includes BFTT, the trainer, TSSS to stimulate radars and BEWT to stimulate the EW suite installed onboard the ship. Not all ships receive the same combination of pieces. Although only BEWT is currently installed on frigates, with the extended life of these ships, BFTT may be installed to support total crew training. Cruisers, Carriers and Amphibious ships all receive different numbers of BOPC's and TSSS units thus the cost varies with each installation.

Starting in 2001, TSSS is being installed on all classes of ships. Ships that already had BFTT installed must be upgraded with installations of TSSS to completely stimulate the radar suites on board. The costs of all these installations must be included in the cost of creating the WCDSN.

The costs and the latest BFTT installation schedule from the West Coast Port Engineer were used to arrive at the yearly depreciated costs attributed to the WCDSN. [Reference 27] Costs are determined for the number of ships by class that have BFTT installed to estimate the cost for that year's ship installations. The installation costs are then allocated over the next five years. Table 18 illustrates the average cost of installing BFTT on each ship class. Individual installations will vary due to different ship configurations but the table includes a typical installation cost.

BFTT Intallation Costs (Ship Class Specific) Cost Data From Port Engineer, Estimate	
DDG	**Cost**
BFTT Intallation	$ 700,000
TSSS (3)	$ 750,000
Total	$ 1,450,000
CG	
BFTT Installation	$ 700,000
TSSS (3)	$ 750,000
Total	$ 1,450,000
LSD	
BFTT Installation	$ 250,000
TSSS (2)	$ 500,000
Total	$ 750,000
LHD	
BFTT Installation (3 BOPC's)	$ 3,500,000
TSSS (2)	$ 500,000
Total	$ 4,000,000
CV	
BFTT Installation (3 BOPC's)	$ 3,000,000
TSSS (2)	$ 500,000
Total	$ 3,500,000
FFG (may not be installed)	
BFTT Installation	$ 1,000,000
TSSS	$ 500,000
Total	$ 1,500,000
Install BEWT only	$ 50,000

Table 18. BFTT, BEWT and TSSS Installation Cost by Ship Class [Reference 27]

Since the BFTT system installed on these ships is used for both internal, single ship training and multi-ship coordinated training, it was necessary to estimate the percentage usage for multi-ship training. No system specification states a multi-ship training target for BFFT usage. Through interviews with BFTT west coast port engineers, an approximation of 60 percent of the trainer's use can be attributed to multi-ship training. Therefore, only 60% of the cost is included in the amount depreciated and attributed to the WCSDN. This percentage was used to determine total system cost.

4. Trainer Control Device Cost

Another vital piece of the system that provides shipboard training is the Trainer Control Device at FCTCPAC, which is a TAC-3 Computer. This computer controls onboard sonar trainers (OBT's) and presents a sonar picture to the ship's Sonar Technicians.

The $30,000 cost of installing this system at FCTCPAC is another infrastructure cost of the WCDSN. As a computer system, the cost of installing this system in 1996 is depreciated over five years as reported in Table 19.

Trainer Control Device	
TCD Installation Annual Depreciation Cost 2001 only	$ 6,000.00

Table 19. Trainer Control Device (TCD) Depreciation Cost

5. Training Systems Not Included in the Infrastructure Costs

This thesis specifically excluded the costs of two systems used for training in the WCDSN. These systems are discussed below, along with the reasons for excluding their cost from the analysis.

a. TACDEW Installation Costs

TACDEW installation costs were not attributed to the training network because the depreciable life of the trainer has ended. TACDEW was installed as a trainer in 1984 and was significantly upgraded in 1987. Fourteen years have passed since the system was installed in its updated version and no further modifications are planned. The system has long outlived the depreciable life of the training system although its longevity and usefulness should be commended.

The lifespan of TACDEW is still unclear. To date, CUBIC contracted maintenance has been sufficient to maintain TACDEW and the system will be used for the foreseeable future. Naval Air Warfare Center, Training Systems Division has investigated the system requirements to replace TACDEW with a new computer system and software, tentatively named Multi-Mission Team Trainer (MMTT), but has not created a final design. No date has been set for TACDEW replacement with MMTT.

This cost analysis could allocate TACDEW replacement cost to the WCDSN but chooses not to allocate replacement cost because an accurate measurement cannot be estimated due to the lack of a replacement design. Additionally, TACDEW is so old, that new computer components are no longer sold and a replacement cost of each component cannot be determined. Additionally, if maintenance is continued on TACDEW, it may be used in its present configuration for four or more years and attributing replacement costs to current year forecasts would be inaccurate. Because there is not an accurate cost estimate for the system, this costs analysis chooses to treat the system costs as fully depreciated, but acknowledges that significant costs may occur in the near future.

b. Submarine Attack Center Maintenance and Installation Costs

The cost of installing the submarine attack center training devices is not included because the trainer was acquired primarily for submarine training on the submarine watch team level. The ability to connect these trainers to multi-ship, in port training is a secondary benefit. The system is only used for multi-ship training once or possibly twice per year when a Battle Group decides to integrate the submarines into the exercise. This equates to less than one week of trainer time used per year.

C. SUMMARY OF WEST COAST SIMULATED TRAINING NETWORK COSTS

The WCDSN is an effective tool when used to train ship crew, but system use incurs substantial recurring and infrastructure costs. Manpower, maintenance and infrastructure are important factors used to evaluate the effectiveness of the training system. In 2001 six MEF, ARG and Battle Groups used the WCDSN to train, prior to underway training and their deployments and this thesis estimates the cost to train these units.

1. Fiscal Year 2001 West Coast Distributed Network Training Costs

Using the cost data for each of the above cost elements and the ship makeup of the participating Battle Groups, this thesis estimates that the Navy used $4,502,442 worth of resources to conduct in port multi-ship training in 2001. Table 20 illustrates the total fixed infrastructure and recurring costs for the year.

2001 Cost Estimate		
Total Fixed Infrastructure Depreciation Expense	$	3,883,782
Total Recurring Costs	$	618,660
	$	4,502,442

Table 20. Total 2001 West Coast Distributed Training Cost Estimate

Table 21 shows the estimated fixed infrastructure costs allocated to the year 2001. This research indicates that the greatest expense is the system infrastructure cost: the BFTT installations, the communication network and the system maintenance costs. Because the Navy has decided to use the WCDS, install BFTT on its ships, and improve the communications network, these costs will be incurred whether or not the system is used for training. The investment has been made and the true question is whether the Navy should leverage these systems to their advantage.

2001 Fixed Infrastructure Cost Estimate				
		Installation Cost		**Allocated Cost**
FCTCPAC MUTTS Cost Estimate				
Training of MUTTS Technicians				3,937
Installation of MUTTS Equipment at PACNORWEST				1,860
MUTTS Van Cost		1,515,000		303,000
ATG MIDPAC Antenna Install				
ATG MIDPAC Antenna Install Manpower Costs				986
Equipment Cost		150,000		30,000
				$ 339,782
BFTT Installation Cost Estimate		**Installation Cost per Year**		**Allocated Cost**
FCTCPAC BFTT Depreciation Cost				**$ 700,000**
Ship BFTT Installation Costs				
Previous BFTT Installation Costs				
	1998	4,400,000		528,000
	1999	7,450,000		894,000
	2000	4,000,000		480,000
Current Year BFTT Installation Costs			4,650,000	
	2001			558,000
Total Deppreciation Allocated				**$ 3,160,000**
Ship BEWT Installation Costs				
Previous BEWT Installation Costs				
	1998	250,000		30,000
	1999	300,000		36,000
	2000	350,000		42,000
Current Year BEWT Installation Costs			750,000	
	2001			90,000
Total Deppreciation Allocated				**$ 198,000**
Ship TSSS Installation Costs				
Previous TSSS Installation Costs				
	1998	-		-
	1999	-		-
	2000	500,000		60,000
Current Year TSSS Installation Costs			1,000,000	
	2001			120,000
Total Deppreciation Allocated				**$ 180,000**
Trainer Control Device				
Trainer Control Device Cost		30,000		
TCD Installation Depreciation				**$ 6,000**
Total Fixed Infrastructure Depreciation Expense				**$ 3,883,782**

Table 21. 2001 West Coast Distributed Training Fixed Infrastructure Cost Estimate

Table 22 shows total WCDSN estimated recurring and variable costs for the year 2001 is $619 thousand. Though these costs are substantial, recurring and variable costs are only 14% of the year's total cost. Again, each costs is driven by a different factor. Both the T-1 and TACDEW maintenance costs are annual costs driven by system usage. Software and maintenance costs are driven by fleet usage and software capability requirements.

Manpower and costs are driven by both the number of exercises in a year and the location of ships participating in the year's exercises. The 2001 exercise cost estimates in Table 22 are based on having conducted six multi-ship WCDSN exercises in 2001 with 22

San Diego, 1 Everett, 1 Bremerton and 4 Pearl Harbor ships participating. The exercise and location data were collected from FCTCPAC training scheduled for the year 2001.

2001 Recurring and Variable Cost Estimate			
Annual T-1 Costs			
From	**To**		
FCTCPAC	NAVSTA SANDIEGO		7,200
FCTCPAC	NAVSTA BREMERTON		35,274
FCTCPAC	NORTH ISLAND		5,172
FCTCPAC	SUBMARINE TRAINING FACILITY SAN DIEGO		4,200
NORTH ISLAND	MAKALAPA (ATM)		16,800
MAKALAPA (ATM)	ATG MIDPAC		5,268
ATG MIDPAC	NAVSTA PEARL HARBOR		5,200
ATG MIDPAC	NAVAL SUBMARINE TRAINING CENTER		5,268
NAVSTA BREMERTON	PACIFIC NORTHWEST MAN		10,000
	Total Annual T-1 Costs	**$**	**94,382**
Annual TACDEW System Maintenance			
Environmental Generation and Control System (EGCS) 20F15A/9			
	Maintenance		8,475
	Supply Support		137
External Voice Communication System (EVCS) 20F15A/11			
	Maintenance		5,879
	Supply Support		300
	Total TACDEW Maintenance Cost	**$**	**14,792**
Exercise Costs			
Manpower Costs			
2001 FCTCPAC Scenario Administration Cost Estimate			5,994
2001 Scenario Generation Cost Estimate			43,814
2001 Exercise Center Manning Cost Estimate			43,392
2001 Submarine TCD Manning Costs Estimate			15,585
2001 Ship Liason Cost Estimate			
	Liason Officer Time		32,059
	Liason Travel Expense		7,400
2001 MUTTS Technicians For Hawaii Events			14,238
2001 MUTTS Technicians For Everett Events			7,492
2001 MUTTS Technicians For Bremerton Events			-
2001 MUTTS Technicians For San Diego Events			46,412
	Total WCDSN Training Manpower Costs	**$**	**216,385**
Other Recurring Costs			
2001 Annual Maintenance Of Radios (Parts)			
Everett & Bremerton			7,000
Pearl Harbor			6,000
FCTCPAC			7,200
Timeplex Equipment, all sites			10,000
	Total Mutts Maintenance	**$**	**30,200**
BFTT Shipboard Operator Training		**$**	**7,492**
BFTT Software Upgrades and Maintenance		**$**	**255,409**
Total 2001 Recurring Cost Estimate		**$**	**618,660**

Table 22. 2001 West Coast Distributed Training Recurring Cost Estimate

During the year, one ARG that was scheduled to participate in a simulated event canceled their training. If this training event were included, the cost to train for the year would have been $4,521,410, as reported in Table 23. This indicates that the marginal cost to train additional units is relatively small compared to the infrastructure costs. The only additional cost to train this Amphibious Ready Group would have been the manpower cost to run the exercise, Table 24. The fixed infrastructure, T-1 line, software, and maintenance costs are already accounted for and are sunk costs. Additional training only incurs the extra manpower costs to run the exercise. Only $19 thousand additional exercise manpower costs would have been incurred for this exercise.

2001 Cost Estimate With Additional ARG Training Eexpense		
Total Fixed Infrastructure Depreciation Expense	**$**	**3,883,782**
Total Recurring Costs	**$**	**637,628**
	$	**4,521,410**

Table 23. Total 2001 West Coast Distributed Training Cost Estimate With Additional Amphibious Ready Group Trainer

2001 Manpower Cost Estimate With Additional Amphibious Ready Group (ARG)		
2001 FCTCPAC Scenario Administration Cost Estimate		6,993
2001 Scenario Generation Cost Estimate		51,116
2001 Exercise Center Manning Cost Estimate		50,624
2001 Submarine TCD Manning Costs Estimate		15,585
2001 Ship Liason Cost Estimate		
	Liason Officer Time	35,493
	Liason Travel Expense	7,400
2001 MUTTS Technicians For Hawaii Events		14,238
2001 MUTTS Technicians For Everett Events		7,492
2001 MUTTS Technicians For Bremerton Events		-
2001 MUTTS Technicians For San Diego Events		46,412
	Total Manpower Costs With Additional ARG	$ 235,353

Table 24. Estimated Additional Cost for Amphibious Ready Group Trainer in 2001

Marginal cost will vary depending on the location and number of ships participating. The $19 thousand added cost in 2001 was for an ARG with all three ships located in San Diego. An exercise with more ships in other ports would incur greater marginal cost.

As more exercises use the WCDSN the Navy will better leverage its investment in the training network. If only one Battle Group uses the system each year, the per-training event cost will be extraordinarily high. Increased Battle Group participation leads to lower marginal cost for units overall. This lower marginal cost is because the primary cost for an additional Battle Group exercise is the manpower and travel costs incurred by FCTCPAC to support the training event. Although the current system is manpower intensive, these costs are small compared to the infrastructure cost. The relatively low manpower cost per exercise indicates that the Navy should increase system use to realize the benefit of creating this network. The model used to create these costs estimates can be used to predict costs based on the number and location of ships participating in training exercises over the next five years.

V. ANALYSIS OF THE SAVINGS OF CONDUCTING WEST COAST DISTRIBUTED SIMULATION NETWORK COMBAT SYSTEMS TRAINING

This chapter will present the savings or benefits that are attributable to conducting in port multi-ship training exercises using the WCDSN. This thesis values the savings achieved by multi-ship in port exercises by estimating the cost to replace multi-ship in port training exercises with underway training exercises. This chapter evaluates the fuel, utility, manpower, range service and maintenance savings achieved by conducting an exercise in port instead of using these services in underway exercises.

Multi-ship in port training exercises have been a part of most west coast Battle Group, MEF and ARG training schedules for the past three years. Ships in these task groups participate from their homeport in exercises to prepare to conduct underway exercises such as ARGERT, COMPUTEX or MEFEX. As discussed in Chapters I and III, this valuable, pre-underway training helps task forces gain initial experience operating together and ensures that ships are prepared to conduct underway training.

The ability to train geographically dispersed ships located in Hawaii, Washington, and California in a simulated environment is a force multiplier that augments and increases the benefit of underway training. The value of accomplishing this training was best described in a post exercise message by the COMCRUDESGRU ONE and the Constellation battle group, "This 'Booster Shot' of training was absolutely vital in an IDTC shortened by 90 days. The only other way to receive the same level of training that the [Battle Group In port Exercise] provided would be to put the entire Battle Group to sea for three days." [Reference 32] The savings value of conducting this training is a reduced underway-training requirement.

Since there is no equivalent exercise run underway prior to a major Battle Group exercise, this thesis values the savings achieved by multi-ship in port exercises by estimating the cost to replace multi-ship in port training exercises with underway training exercises. The following sections estimate and discuss the fuel, utility, manpower, range service and maintenance savings achieved by using the WCDSN.

A. FUEL SAVINGS

Normally, underway multi-ship training requires travel to a rendezvous in the same geographic area at an exercise range. One of the major ship operating expenses is the fuel used for this travel. The majority of our surface combatants, approximately 93%, consume marine diesel fuel. The consumption of fuel can be expensive as main engines and auxiliary plants use large quantities of fuel when a ship transits or operates at high speed while maneuvering during an exercise.

Fuel costs have been an issue during the last several years as O&M accounts have had to absorb added costs from contingency operations, aging equipment and rising fuel prices. For example, ships in the Seventh Fleet canceled or shortened deployments due to shortages of funds in fiscal year 2000. [References 34, 35] For years, Fleet Commanders have limited the transit speeds of vessels traveling from one location to another to save fuel. Keeping ships in port to conduct initial Battle Group training can reduce some underway requirements and save fuel.

Multi-ship in port exercises save fuel costs by reducing the number of underway days (and the fuel required during those days) during the IDTC. The fuel savings is achieved by two means: training in port instead of underway and eliminating the underway days needed to sail from homeport to an exercise OPAREA.

For this analysis exercise days were counted as underway-operating days saved. Most exercises are three days long. Therefore, each ship saves the equivalent of three underway days worth of fuel. The number of ships that conduct these exercises times three operating days per exercise provides the number of exercise steaming days saved.

The second fuel savings results from not sending geographically dispersed Battle Groups from their individual homeports to the same operating area to train. For instance, the USS CARL VINSON Battle Group has ships in Bremerton, Pearl Harbor, San Diego and Everett. To train in the same location each ship would have had to sail to the Southern California Operating Areas. Ships must sail nine days from Pearl Harbor and four days from Bremerton or Everett Washington, just to get to an exercise area.

Note that the Battle Group achieves other advantages from in port training. Battle Groups can use the saved days for other training that must be conducted at sea. In addition, the elimination of these travel days also adds valuable time in port for sailors. No attempt was made to quantify these benefits due to the measurement difficulties involved.

To calculate fuel savings, this thesis calculated the number of saved operating days, per ship, for the year 2001. This included calculating the number of days saved by each ship traveling from its homeport to the SOCAL operating area. San Diego ships did not add a travel days due to their proximity to the SOCAL operating area. In addition, three days underway time per ship per exercise were included. Finally, the number of days each ship is underway during its return to homeport is added. This thesis used actual ship class and homeport location data from simulated exercises conducted during the year 2001 to arrive at the number of total operating days saved. Table 25 illustrates the estimated operating days saved for the year 2001.

Saved Operating Days Conducting Simulated Exercises (Includes Days to Transit to SOCAL OPAREAS for Training)	
CG	51
DDG	30
DD	6
FFG	42
CV*	17
LSD	6
LPD	6
LHA	3
LHD	3
SSN	90
Total	**254**

Table 25. Estimated Number of Saved Operating Days by Ship Class
(Based on Ship Location and Travel Requirements for Exercises conducted in FY01)

The total of these saved operating days is multiplied by the daily ship class fuel costs from the CINCPACFLT ship operations model, which uses OP-41 data, to value the fuel savings of conducting simulated exercise vice underway exercises. The number of operating days saved times the fuel cost to operate that ship per day equals the savings for that ship class for the year. No fuel savings was included for nuclear powered submarines or carriers because of the difficulty in estimated the nuclear fuel savings per day. Table 26 illustrates the estimated FY 2001 fuel savings.

Fuel Savings		
CG		1,561,775.04
DDG		760,636.80
DD		152,621.28
FFG		449,467.20
CV*		252,763.56
LSD		78,039.36
LPD		74,088.00
LHA		116,935.56
LHD		91,992.60
SSN		0.00
Total savings	**$**	**3,538,319.40**

Table 26. Estimated FY01 Fuel Savings Using CPF Fuel Cost Model

Note that the WCDSN infrastructure funding requirements from Table 21 are nearly offset by the estimated $3.5 million fuel savings from conducting training in port vice underway training. This estimated savings also accounts for approximately 79% of total WCDSN costs for 2001. If future years include more in port exercises per year the fuel savings will increase.

B. NEGATIVE UTILITY SAVINGS

While the funds spent on fuel are saved, added utility cost is incurred by keeping a ship in port for an extra day. Ships that remain in port typically do not generate their own electricity or create their own water and must pay for these and other services such as sewage. At sea, ships use their own machinery to make water and electricity and dispose of sewage. This equipment is considered a sunk cost and no savings is realized by eliminating its use through exercising in port. The negative utilities savings resulting from the added days in port for ships conducting simulated exercises is subtracted from the fuel savings achieved.

The estimated daily utilities cost in the CINCPACFLT ship cost model, with OP-41 data, is used to estimate the extra utilities cost incurred by ships remaining in port to participate in multi-ship exercises. The model's predicted daily utility cost, by ship type, is multiplied by the number of additional in port days to determine the added utilities cost in the year 2001. Table 27 shows the number of additional in port days by ship class and the estimated total negative utilities savings for 2001.

Negative Savings For Utilities	Added Days In	Added Utilites
CG	51	114,418.4
DDG	30	50,855.8
DD	6	9,528.1
FFG	42	50,301.9
CV*	17	166,564.4
LSD	6	16,941.6
LPD	6	15,030.7
LHA	3	20,677.1
LHD	3	18,098.5
SSN	90	156,559.9
	254	$ 618,976.7

Table 27. Estimated Negative Utilities Savings 2001

C. MAINTENANCE SAVINGS

This thesis found no model that links total ship maintenance cost to the number of days spent underway. Because no reliable model can be used to quantify the total ship maintenance costs saved by training in port instead of at sea this thesis does not include this benefit. . Theoretically, since equipment wear and tear increases with the number of underway days, increased maintenance costs are incurred. An overall maintenance cost model would be useful for identifying savings achieved by reduced underway days. Fleet Commanders should, however, consider the potential benefit of reduced operating days on ship maintenance costs when evaluating the potential benefits of simulated exercises.

D. POTENTIAL FLEET RANGE SAVINGS

This thesis assumes that if multi-ship training were to be conducted at sea, training ranges such as the Southern California Offshore Range (SCORE) would be required to conduct similar training. An added benefit of conducting simulated ASW, SUW and AAW exercises is that ranges such as SCORE are not needed, as they would be for underway exercises.

1. Range Funding Trends

The CINCPACFLT Fleet Training Range Operational Support (ROS) Program funds annual O&M expenses for Fleet Training Ranges. The program's primary resource sponsor is OPNAV N78, but the program is typically heavily augmented through Congressional action for the Pacific Missile Range Facility (PMRF). [Reference 29] The overall trend in CINCPACFLT's Tactical Training Ranges budget has been a steady decline. The anomaly in FY01 is due to a relatively large Congressional plus-up. Training range funding shortfalls mean that simulated events should be used to augment, but not replace, underway exercise training requirements to save valuable range services for events that can only be conducted underway. Figure 4 depicts N78 Resource Sponsor support in light gray and the annual Congressional plus-up in dark gray. Of note, the Congressional plus-up comes "ear-marked" for PMRF and does not provide CINPACFLT any flexibility for realignment to a greater need, such as additional Battle Group exercises.

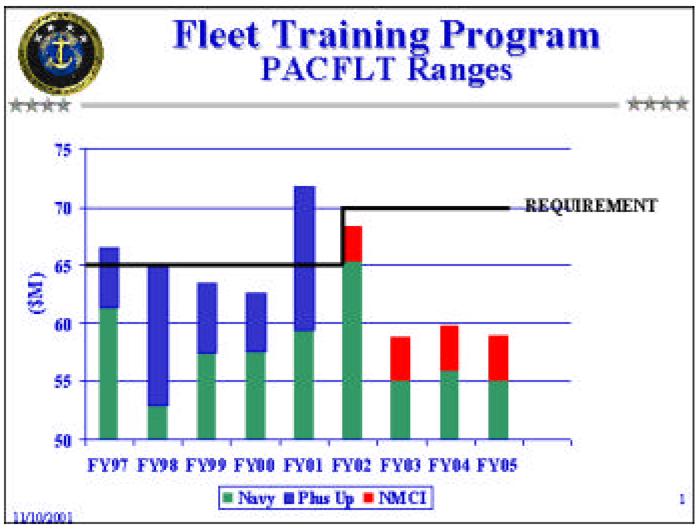


Figure 4. Pacific Fleet Range Funding Trend

When Congressional plus-ups are insufficient to cover shortfalls, CINPACFLT has to realign monies from other PACFLT programs to fix facilities and conduct needed exercises. The take-away from the chart is that a critical shortfall is anticipated in FY 03 and out. CINCPACFLT determined that they will face shortfalls that will very negatively impact their ranges' ability to support Fleet readiness requirements at SCORE, FALLON, YUMA, and to provide the new surface target support in SOCAL. Recent events may affect the gaps as the nation focuses on preparing its forces for the battle against terrorism.

2. Range Operation Savings Equivalency

The SCORE range is most often used by surface ships for exercises. CINPACFLT funds SCORE on an annual. Some of SCORE range costs are variable and can be avoided by not training at their ranges, while others are fixed. Variable costs include people to monitor the range, record data, and small boats and surface targets for live fire events.

Other costs such as range facilities will be incurred whether the range is used or not. Figure 5 shows that approximately $12 million was funded for SCORE operations in 2001. An additional $2.7 million was funded for target preparation and other contract support for surface training.

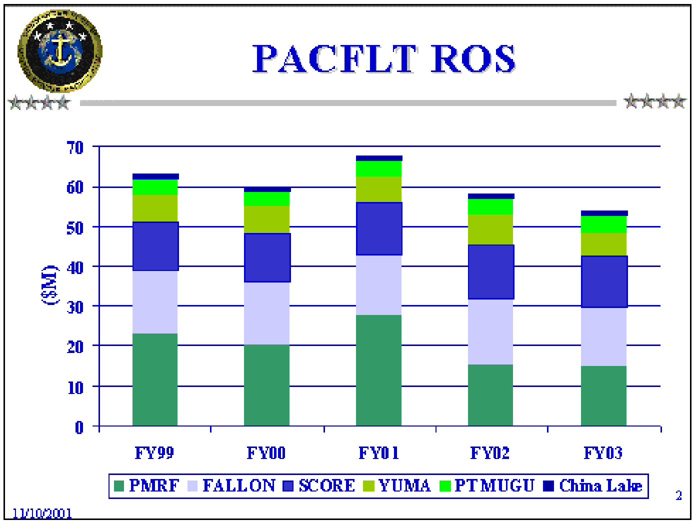


Figure 5. Pacific Fleet Range Operations Support Data

Because the cost to train additional units cannot be precisely determined, annual SCORE range savings were roughly estimated for the year. Dividing total SCORE range costs by the number of ship hours the SCORE range is used provides an estimated allocated range cost per hour. This thesis assumes that the equivalent range time to replace multi-ship in port exercises increases training range costs. The estimated ship hour range cost is then used to assign costs to saved range days. This cost savings is a substitute Measure of Effectiveness for the benefit of an in port trainer.

Table 28 shows the total budgeted cost of ranges used by surface ships plus target preparation costs for the year 2001. This number is divided that by the number of hours the ranges are used by surface ships to determine the range costs per hour. The table calculates that a day's usage is eight hours and that a three-day exercise will use three the range for twenty-four hours total. The estimate also assumes that all exercise ships participate at the same range and that the total range hours used per day is eight. This assumes that no additional costs are incurred by multiple ships using the range simultaneously. This is not a perfect estimation of the SCORE range savings since some of the range costs are fixed.

Range Equivalency Savings		
Annual Cost of		
		12,000,000
Target		2,700,000
	$	14,700,000
Ship Hours		
Range used Per		6509
Average Cost Per Hour	$	2,258
Hours Per Three Day		24
Number of Exercises in		6
Range Savings	$	325,211.2

Table 28. Equivalent Score Range Savings

E. MANPOWER SAVINGS

Although fuel savings represent a significant savings attributed to in port exercises, the largest savings is achieved through manpower benefits of exercising in a simulated environment in port instead of at sea.

1. Administrative Savings to Shipboard Sailors

Data from surveys, interview responses and messages from ship Commanding Officers indicate that simulated in port exercises saved crew time for those who normally coordinate a comparable underway exercise. For instance, prior to an exercise, these individuals write and send coordination messages to participating ships. These messages provide information about the location and type of events, communication frequencies, and other exercise specific requirements. Moreover, a ship's training team must script an exercise and ensure that the scenario will run properly. Finally, the ship's training team must run the scenario and evaluate watchstander performance throughout the exercise

Feedback indicates that a substantial time savings is achieved during an in port exercise because FCTCPAC drafts and sends all pre-exercise messages, scripts, and then runs and evaluates the exercise scenarios. For example, the Commanding Officer of the USS SULLIVANS was quoted to say that simulation systems provide a tremendous advantage because "it reduced the number of training team personnel needed to execute a basic TLAM/Harpoon scenario from ten to four." [Reference 33] Also, he added that this allowed him to train his entire watch team including those normally required to participate as the trainers.

Interviews on the USS RUSSEL indicate that the pre-exercise administrative savings ranged from one half day to about three days. One half day was used as a conservative estimate of the administrative time savings per ship. Those interviewed also indicated that typically a senior petty officer wrote and edited the messages. The thesis uses the daily rate for an E-6 for one day per ship per exercise. Table 29 reflects this administrative savings per ship. This amount will be multiplied by the number of ships participating in simulated exercises to determine total 2001 savings.

Interviews on USS RUSSEL also indicated that the shipboard Combat Systems Training Teams (CSTT) did not have to create and script scenarios. The number of CSTT man-hours saved varied from four hours to several days depending on the length and intricacy of the scenarios used in an exercise. Furthermore, FCTCPAC training personnel ran exercise scenarios, participating ship-training teams did not have to run the scenario themselves. Each ship saved a training team member for the duration of the exercise. Finally, each ship also saved between one or two CSTT observers who normally evaluate the watch team because the FCTCPAC Liaison Officer and Exercise Control Evaluators helped evaluate ship performance.

The following chart is an estimate of the man hour savings achieved, per ship, for an exercise using low end estimates of the amount of time saved by each ship for administrative work, scenario scripting and exercise run operation and evaluation. E-6 and E-7 daily wage rates were used to account for training team time because training team members are normally composed of senior enlisted watchstanders on the ship.

Administrative Manhour Savings Per Ship					
Admin	**People**	**Days**	**Total Days**	**$ Per Day Savings**	**Savings**
E-6	1	0.4	0.4	249.74	99.90
CSTT					
E-6	1	2.5	2.5	249.74	624.35
E-7	2	2.5	5	287.31	1,436.54
Total					$ 2,160.78

Table 29. Estimated Per Ship Administrative Savings

Ships Participating in 2001 Exercises	
CG	5
DDG	4
DD	2
FFG	8
CV*	3
LSD	2
LPD	2
LHA	1
LHD	1
Total Number of ships	28

Table 30. Ships Participating in 2001 Simulated Exercises

These per ship estimated savings were multiplied by the number of ships that participated in multi-port simulated exercises during the year 2001 from Table 30. Table 31 shows the estimated cost savings by ship class and the $60.5 thousand total savings achieved for 2001.

Admin Manhours Saved per Exercise	
	Savings
CG	10,803.90
DDG	8,643.12
DD	4,321.56
FFG	17,286.25
CV*	6,482.34
LSD	4,321.56
LPD	4,321.56
LHA	2,160.78
LHD	2,160.78
Total	$ 60,501.86

Table 31. Total Estimated 2001 Shipboard Administrative Hours Savings

2. Sailor Days Savings

Potentially, the largest benefit of conducting initial battle group training in port comes from the manpower savings achieved by keeping sailors in port. Studies have shown that increased time at home has had a positive impact on military retention and Quality of Life for single and married sailors. Similar studies, evaluating the impact of training sailors in their homeport, indicate that a substantial increase in Quality of Life can be achieved through Video Tele-Training classes and distance learning. [Reference 30]

Multi-ship simulated training operates under the same principle. Ship crews do not have to get underway and sail to another location to train. Instead they are able to spend enjoy more off-hours, at home with their families, increasing their personal skills or in recreational activities. The number of saved sailor days can be estimated by multiplying the number of exercise days saved, by ship class, by the number of sailors assigned to ships participating in simulated exercises.

Navy ships are typically not manned 100% until deployment but are manned at between 85-95 % during the training cycle. To determine the number of saved sailor days, 90% manning was chosen as a midpoint. Table 32 shows the sailor day savings based on the ships that conducted multi-ship in port training in the year 2001 and their homeport location.

Saved Sailor Days			
	Ship Operating Days Saved	Ship Manned 90%	Total Sailor Days Saved
CG	51	338	17213
DDG	30	306	9180
DD	6	297	1782
FFG	42	194	8127
CV*	17	2790	47430
LSD	6	329	1971
LPD	6	360	2160
LHA	3	954	2862
LHD	3	990	2970
SSN	90	117	10530
Total Days	254		104225

Table 32. 2001 Sailor Days Saved Through Simulated Exercises (CV* includes nuclear and conventional carriers)

Estimating the value of the sailor days saved in Table 32 is a difficult task. Should the sailor days saved be an estimate of the Navy's retention savings due to fewer days away from home and an increased Quality of Life? Should savings from increased days in port be estimated using the value a sailor puts on having one more day to spend with his or her family?

Factors other than underway time, such as education, command atmosphere, and fulfilling work experience, affect retention rates. Additionally, a family man may value a day in port as priceless while a single sailor might rather sail to a foreign port. The value of a day in port to a sailor will be as variable as the number of sailors in the Navy.

The best, estimation of the value of a saved sailor day is represented by the value the Navy assigns to an extra day away from home in the Individual PERSTEMPO (ITEMPO) program. This program was instituted because too many sailors and officers were frustrated with increased deployment requirements in today's Navy.

The ITEMPO program is the Navy's response to the requirement to implement a system to track and manage, on an individual basis, the Personnel Tempo (PERSTEMPO) of every member of the armed forces. Unlike other Navy PERSTEMPO initiatives, which pertain to a unit as a whole, this program was developed to help account for, and manage the amount of time every sailor in the Navy, officer and enlisted, active and reserve, is required to be away from his or her permanent duty station/homeport. [Reference 31]

The ITEMPO program not only tracks underway periods for shipboard sailors, but also tracks time away from a permanent duty station for sailors attached to other deploying mobile units. Furthermore, the program will track those occasions when a sailor is in homeport, but is unable to spend off-duty time at his or her civilian residence. Examples of ITEMPO deployment events are: underway periods for members assigned to navy ships or vessels (including at-sea periods in the local operating area, exercises outside the local area of the Permanent Duty Station or homeport, or a major deployment). [Reference 31]

The ITEMPO program established high-deployment pay: which establishes an entitlement to high-deployment pay for members whose ITEMPO deployment days exceed a Congressionally mandated threshold. An individual that exceeds this threshold, and continues to be deployed, receives $100 per day. [Reference 31]

ITEMPO deployment days are counted whether a ship is forward deployed or whether it is underway for training. To only examine the days a sailor is deployed for ways to keep them under the deployment limits is foolish because these underway days represent only a portion of an individual's underway time. Commanders should strive to save as many underway days in the training cycle as possible and use these days when they are crucial for operational needs.

The Navy has determined that the value of one additional deployed day is $100 in addition to that sailor's normal salary. The Navy is willing to pay every sailor $100 per day for every day over that threshold and believes that the sailor is fairly compensated for his or her time.

Whether the $100 per sailor day is the savings the Navy will receive due to a reduced underway day or the benefit that the sailor receives due to not being away from home, this value was used to determine the marginal savings per saved sailor day. Multiplying the total number of saved sailor days in Table 32 by the Navy's $100 estimate resulted in an estimated $10.4 million benefit of conducting multi-ship in port exercises. Table 33 shows the estimated value of sailor days saved in 2001.

Days In Port Savings	
CG	1,721,250.
DDG	918,000.0
DD	178,200.0
FFG	812,700.0
CV*	4,743,000.
LSD	197,100.0
LPD	216,000.0
LHA	286,200.0
LHD	297,000.0
SSN	1,053,000.
Total	$ 10,422,450.

Table 33. Estimated 2001 Sailor Days In Port Savings

F. SUMMARY OF WEST COAST SIMULATED TRAINING NETWORK BENEFITS

Chapter IV and this chapter have presented detailed analysis of the estimated cost savings and increased costs from the use of in port multi-ship simulated training. This chapter has shown that substantial benefits are realized when the WCDSN is used to train deploying units prior to underway training. Given that ships need training and sailors find the training valuable, the fuel, manpower and potential range savings are greater than the cost to conduct these exercises. These savings are enough to merit continued use of the WCDSN for training even without considering qualitative benefits such as increased training opportunities, advantages of simulated exercises, and ship maintenance savings.

1. Year 2001 West Coast Distributed Network Training Benefits

Using the savings data for each of the above elements and the ship makeup of the participating Battle Groups, Table 34 reports that the Navy saved $13,727,500 in resources by conducting simulated training in fiscal year 2001. Table 35 shows that when compared to the $4,502,442 cost to maintain and operate the WCDSN, a net savings of nearly $9.225 million was estimated.

2001 Total Estimated Savings	
Fuel Savings	$ 3,538,319.40
Days Inport Savings	10,422,450
Negative Savings For Utilities	(618,977)
Admin Manhours Saved	60,502
Range Savings	325,211
Total	$ 13,727,506

Table 34. Total Estimated Savings For 2001

Net Estimated Savings for 2001	
Total Fixed Infrastructure Depreciation Expense	$ 3,883,782
Total Recurring Costs	$ 618,660
Total Estimated Cost	$ 4,502,442
Fuel Savings	$ 3,538,319.40
Days Inport Savings	10,422,450
Negative Savings For Utilities	(618,977)
Admin Manhours Saved	60,502
Range Savings	325,211
Total Estimated Savings	$ 13,727,506
Net Estimated Savings	**$ 9,225,064**

Table 35. 2001 Net Estimated Savings

As was previously mentioned in Chapter IV, one ARG canceled its in port exercise during 2001. Had the ARG training occurred, Table 36 shows the estimated yearly savings would have been $14,425,711, or approximately $700 thousand higher. This indicates that the marginal benefit to train additional units is high compared to the cost to maintain and operate the network. Of course, marginal cost savings will vary depending on the homeport location and number of ships participating in an exercise.

2001 Total Estimated Savings With Additional ARG	
Fuel Savings	$ 3,706,376
Days Inport Savings	10,926,000
Negative Savings For Utilities	(653,061)
Admin Manhours Saved	66,984
Range Savings	379,413
Total	$ 14,425,711

Table 36. Total Estimated Savings for 2001 With Additional ARG Training

Research indicates that the greatest benefits of training using the WCDSN are the manpower benefits realized by keeping sailors in port and the net fuel savings achieved by not sending ships to the same underway operating area to train. Again, increased Battle Group participation leads to increased savings and benefits. The costs of running the system are not paid for by simply one Battle Group using the system. As system use increases, the per exercise marginal benefit increases.

Because each Battle Group is composed of ships from different homeports and travel times vary, no specific breakeven analysis will be accurate. Different combinations of ships and homeports will affect the savings of each exercise. The model used for analysis in this thesis can be used to predict the value of training Battle Groups composed of different combinations of ships, however.

THIS PAGE INTENTIONALLY LEFT BLANK

VI. WEST COAST DISTRIBUTED SIMULATION NETWORK TRAINING CONCLUSIONS AND RECOMMENDATIONS.

A. CONCLUSIONS

Emerging technologies have changed the way the Navy trains its people and the Pacific Fleet is adapting to take advantage of these technologies. This thesis has shown that the West Coast Distributed Simulation Network (WCDSN) is an effective Battle Group Training tool. Specifically, the exercises using this network and its simulation capabilities should be used to supplement underway-training opportunities. This simulated training has been proven to augment underway training and reduce the pressures created by fiscal, scheduling, environmental, manning and other constraints. Furthermore, simulation, as a training tool, will become more important as future surface combatants decrease manning and budgets decline.

Using the WCDSN fulfills one of the tenets of the 2001 Quadrennial Defense Review (QDR), in that it transforms the way that the Department of Defense (DOD) trains. The QDR states that the DOD should “use distributed learning technologies to reengineer individual training and job performance.” [Reference 37] Distributed Battle Group training is an innovation that meets mission training requirements and prepares the Navy’s ships for deployment. The Pacific Fleet must continue to use simulated training and invest in the network to provide it’s sailors the best possible training. This thesis has shown that the benefits of using the network exceed the investment (fiscal and personnel) requirements to operate and maintain it.

While some disadvantages to simulated training exist, such as the risk of equipment casualties, “trainerisms,” dated software and old threats; there are many non-quantifiable advantages to simulated training. Specifically, replay, debrief, direct control and manipulation of the scenario in order to improve sailors’ training opportunities. These deployment training opportunities are invaluable and are major advantages when considering the value of training.

An analysis of conducting simulated training exercises have shown that the people who use the network believe the training is effective. Emerging technologies and fleet feedback will continue to improve the training systems and the network. The exercises give sailors a valuable experience that can be used later in the IDTC. Users have expressed that the simulation is realistic, the scenarios are challenging, and that they gain valuable experience operating in Battle Group situations. Furthermore, these sailors believe that in port simulated exercises are a viable alternative to training underway.

Given that the sailors find the training useful, the WCDSN has been found to be cost effective. The cost to train Battle Groups using the WCDSN is high, but the benefits substantially outweigh the costs of providing this training. As previously shown in Chapter V, the Navy saved $13,727,500 by conducting simulated training in fiscal year 2001, and realized a net savings of nearly $9.225 million. FCTCPAC and NAVSEA PMS 430 invest significant resources and time to conduct an exercise.

The result of this investment is a substantial return on investment to fleet readiness. Overall net savings depend heavily on the system's continued use. The estimated costs of phone lines, training system installations and radio equipment should not significantly increase. The incremental cost of using training commands and the WCDSN to train Battle Groups is small compared to the savings achieved by not getting Battle Groups underway to train. Thus, the Navy should encourage as many Battle Groups as possible to use the system. The Fleet and the training community must plan, program and budget to provide these training opportunities to the fleet.

B. RECOMMENDATIONS.

The information and analysis in this thesis produces the following recommendations regarding the WCDSN:

1. Battle Groups, ARGs and MEFs should continue to conduct simulated training exercises using the WCDSN prior to deployment. Additionally, Fleet Commanders should consider whether simulated exercises can and should be used as refresher training for Battle Groups that deploy a long period after their final underway exercise, COMPTUEX (Composite Training Unit Exercise). Such supplemental exercises could provide training value when ships require training late in the IDTC cannot adjust their underway schedules. These additional training events will produce higher rates of return on network investment since variable system costs are significantly lower than the incremental benefits gained by Battle Group training.

2. Continue to conduct in port exercises as a part of the IDTC to improve sailors' Quality of Life. The days in port savings provides an important benefit to the Navy and its sailors. Training in port allows sailors to return to their homes at the end of a training

day and the Navy saves scarce underway-operating days. These days can be used to conduct other exercises that can only be accomplished underway.

3. CINCPACFLT is developing a set of training requirements that are fulfilled by conducting simulated events. It is important to ensure that ships are aware of that these simulated events provide equivalent qualifications and that ships track these simulated training events and take credit for their successful completion. Additionally, ships should use these simulation systems to complete recurring training requirements. CINCPACFLT must continually evaluate this policy. The Fleet must examine how the use of simulated training affects the readiness of the fleet and determine whether additional training requirements can be accomplished using simulation or whether training events should be eliminated because simulation systems do not do an adequate job. CINCPACFLT must monitor Fleet feedback for areas of concern and improvement.

4. CINPACFLT and FCTCPAC should continue to work with PMS 430 to improve the network and its reliability. One of the system's current flaws is that significant manpower requirements are needed to operate and maintain the network. These commands should look for new technologies that will decrease the maintenance manpower requirements as new communications network technology becomes available. Investment in new technologies and improved reliability should be rewarded by lower system maintenance costs, lower system manpower costs and improved reliability and realism for the sailor receiving the training.

5. FCTCPAC, and PMS 430 should coordinate with CINPACFLT to ensure that the WCDSN bandwidth is available on future Pacific Coast networks such as the Navy and Marine Corps Intranet, ADSN or BLII. The current T-1 network is expensive to maintain and potential savings may be achieved by including the WCDSN on one of these paths. Shifting the path to the Navy and Marine Corps Intranet may achieve connection savings as well as the manpower required to ensure that these networks are properly maintained so that the bandwidth is available when needed.

6. FCTCPAC should consider outsourcing as an option for the MUTTS site maintenance requirements in order to reduce manpower, travel and repair costs. The current system of sending FCTCPAC technicians is necessary because FCTPAC personnel are the only Navy assets that have the required skills and knowledge to prepare the network for training. Flying people to multiple locations on the West Coast and to Hawaii to conduct each trainer is a costly process. Because this is inefficient, FCTCPAC should consider adding the WCDSN maintenance costs to the West Coast COMS contract that covers TACDEW maintenance when it is re-competed in two years.

7. Battle Group Commanders should coordinate with FCTCPAC to better define the fleet exercise training requirements. In preparation for distributed exercises FCTCPAC develops specific goals with the commanders and writes scenario scripts to provide the training desired by the Battle Group Commander. FCTCPAC and Battle Groups should continue to improve this process by creating event driven scenarios that provide guaranteed mission specific training for each ship in the Exercise. Make sure that each

ship is able to receive quality USW, AAW, and SUW training in each exercise by scripting specific events for each ship. Continue to improve this process by creating scenarios with more tracks, and more complex scenarios. Continually improving the scenario scripting process will make sure that all watch teams, on each ship, are included in exercises.

8. Research indicates that current scenarios provide excellent Battle Group training, however, FCTCPAC should continue to improve scenarios. Research indicates that ships want more intricate and complex scenarios. The addition of submarine participation and strike warfare to recent Battle Group exercises has been an enormous success. The Navy should continue to increase the reality of scenarios by adding joint warfare training opportunities.

9. FCTCPAC should seek additional training partnerships with ATGMIDPAC and ATG PACNORWEST so that they are not required to send liaison officers to ships in distant homeports. The cost to send these representatives to each ship during an exercise could be saved by using ATG representatives in the local area that are familiar with the training network and these simulated exercises. FCTCPAC should examine whether partnering with these other training commands will provide people who can coordinate with exercise control and respond to network casualties. FCTCPAC may realize substantial savings if these commands can send augment FCTCPAC staff.

10. CINCPACFLT and FCTCPAC should encourage PMS 430 to develop semi-automated forces. Scripting and running large Battle Group Exercises is manpower intensive. These variable manpower requirements are a large portion of an exercise's cost and can be reduced through the use of semi-automated forces. Semi-automated forces will reduce the number of people needed to run exercises and reduce the per-exercise cost. FCTCPAC should push for semi-automated forces to be included in future BFTT software upgrades and in Multi-Mission Team Trainer (MMTT), the replacement system for TACDEW.

11. CINCPACFLT should conduct an analysis of the next Battle Group that completes the IDTC without conducting an in port exercise. The Battle Group's performance in COMPUTUEX should be compared Battle Groups' that completed an import training exercise, to determine whether in port exercises are truly a training enabler.

12. CINCPACFLT should encourage its ships to participate in distributed simulation training on their ships vice in mockups at FCTCPAC. Sailors who use both systems indicate that the training received on their own ship's consoles is more beneficial than the training received in a mockup.

C. NEED FOR FURTHER RESEARCH

This thesis could not address all the issues associated with simulated training in the Navy. As a result, several topics require further analysis. Future research should focus on the following issues and questions.

What Warfare Mission Areas are best trained through the use of simulation? Is air defense too fast for simulated training or do future simulation systems provide better training than underway training? Do simulated exercises train surface warfare better than air warfare?

Does a ship that trained underway perform better than a ship that has significant simulator training? Two ships should be compared to determine whether simulation has advantages or disadvantages that can be quantified.

Is there a way to measure the benefits of the non-quantifiable advantages and disadvantages of simulated training?

Does increased simulated combat systems training reduce the training opportunities for other underway training?

What training specific requirements can be satisfied using simulated training?

Does a ship have to actually fire a missile to be qualified to shoot one if a simulated exercise teaches all the required skills? Does simulated training provide a better learning experience for qualifications?

Can manpower costs be reduced through the use of semi-automated forces?

Does a better valuation method for sailor saved days in port exist?

Is there a way to measure total ship maintenance costs per underway day? Can that measurement be included in the savings benefit of training in port?

Is there a method to evaluate the savings resulting from not having to use other Navy assets such as ships, submarines and aircraft to act as enemy forces for underway exercises? How does the fleet compare simulated exercises with numerous opposing contacts to the limited number of contacts for underway exercises?

APPENDIX A. THESIS SPECIFIC SURVEY FOLLOWING DISTRIBUTED MEF TEAM TRAINER (USS RUSSEL AND USS FORD)

Distributed Combat Systems Training Questionnaire

SA--Strongly Agree
MA--Mildly Agree
U--Undecided
MD--Mildly Disagree
SD--Strongly Disagree
N/A--Not applicable to me/Don't Know

Command and Control

1. This trainer helped me understand which warfare and operational commanders my ship will report to when deployed.

SA **MA** **U** **MD** **SD** **N/A**

2. I have a better understanding of my MEF/Battle Group's reporting procedures.

SA **MA** **U** **MD** **SD** **N/A**

3. This trainer gave me practical experience applying the MEF/Battle Group's OPTASKs to real world situations.

SA **MA** **U** **MD** **SD** **N/A**

4. I have a better understanding of the importance of maintaining an accurate LINK11/16 picture.

SA **MA** **U** **MD** **SD** **N/A**

5. I know how to apply my battle group's OPTASKS.

SA **MA** **U** **MD** **SD** **N/A**

Communications

6. I have a better understanding of who to report air contacts to.

SA **MA** **U** **MD** **SD** **N/A**

7. I have a better understanding of when to report air, surface, sub-surface contacts.

SA **MA** **U** **MD** **SD** **N/A**

8. I have a better understanding of radio communication reporting procedures and formatting.

SA **MA** **U** **MD** **SD** **N/A**

9. I have a better understanding of my ship's contact reporting procedures.
SA MA U MD SD N/A

Multi-Ship Operations

10. This training event helped me understand my ship's duties in MEF/Task Group operations.
SA MA U MD SD N/A

11. This training event provided good experience operating in a multi-ship environment.
SA MA U MD SD N/A

12. I feel more confident in my ship's ability to operate in a MEF/Task Group.
SA MA U MD SD N/A

13. I am confident in my ship's ability to coordinate tracking, intercepts and reporting with other ships of this task group.
SA MA U MD SD N/A

Tactics

14. I have a better understanding of Maritime Interception Operations.
SA MA U MD SD N/A

15. I have a better understanding of Air Defense tactics.
SA MA U MD SD N/A

16. I have a better understanding of Surface tactics.
SA MA U MD SD N/A

17. I have a better understanding of Under Sea Warfare
SA MA U MD SD N/A

Individual

18. I feel more confident in my ability to perform my watchstation duties due to this trainer.
SA MA U MD SD N/A

19. The simulations in this scenario provided realistic training opportunities at my watchstation.
SA MA U MD SD N/A

Realism

20. This training event challenged me with realistic and challenging scenarios with actual threats and opposing tactics.

SA	**MA**	**U**	**MD**	**SD**	**N/A**

21. This training event used realistic simulations.

SA	**MA**	**U**	**MD**	**SD**	**N/A**

22. Multi-ship simulated scenarios provide a realistic alternative to underway some <u>combat systems training</u> (do not consider navigation, engineering training, etc.)

SA	**MA**	**U**	**MD**	**SD**	**N/A**

23. This trainer met or exceeded my expectations.

SA	**MA**	**U**	**MD**	**SD**	**N/A**

Other Questions

24. A training organization that provides standardized combat systems scenarios would reduce the amount of work my combat systems training team spends creating scenarios during the training cycle.

SA	**MA**	**U**	**MD**	**SD**	**N/A**

Background Information

25. I am an:

E1-E3	E4-E6	E7-E9	O1-O3	O3-O5	O6+

26. I am on my ship's Combat Systems Training Team

Yes	No

27. I have participated in other multi-ship distributed combat systems simulation scenarios.

Yes	No

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B. MIDDLE EAST FORCES TEAM TRAINER SURVEY IN MOCKUP AT FCTCPAC (USS OLDENDORF AND CDS 23)

FCTCPACINST 1550.4J C

END OF TEAM TRAINING CRITIQUE

Name:______________________________ Date:__________

Rank/Rate: __________ Command: ______________________

Course.______________________________ Class #__________

Using the number system below, place an X in the box that indicates your agreement with each statement listed:

N –NOT APPLICABLE
1 - STRONGLY DISAGREE (Unsatisfactory)
2 – DISAGREE (Lacking/Marginal)
3 – AGREE (Satisfactory)
4 - STRONGLY AGREE On the mark/Very good)
[4 is the best; 1 is the worst]

	CURRICULUM AND FACILITIES	N	1	2	3	4
1	Staff was prepared to conduct the training sessions					
2	Staff provided necessary guidance/assistance during training					
3	Staff exhibited a high level of dedication and professionalism					
4	The critique/debrief sessions identified individual and team problems					
5	Safety precautions were explained and emphasized throughout the training					
6	Equipment was safe for use					
7	Security was explained and emphasized throughout the training					
8	Classrooms/Labs/Mockups were clean, properly lighted and heated/cooled					
9	Scenarios were appropriate for the team					
10	Training was organized in a clear and logical manner					
11	The training was realistic and challenging					
12	The training was presented at the appropriate level					
13	Training equipment was in good condition					
14	Security of classified material was explained and emphasized					

We would appreciate comments with recommendations below for any items marked 1 or 2.
Please provide comments below on anything or anyone that you feel are noteworthy.
Fleet Combat is committed to your success in your assignment. Your constructive input will help us improve the product.

COMMENTS/SUGGESTIONS:______________________________

You are not required to put your name on this form; however for personal feedback and to help us make the necessary corrections or provide deserved recognition, a name is helpful and encouraged.

FCTCPAC FORM 1550/5 (3/99) ENCLOSURE (3)

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C. FCTCPAC DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER SURVEY (USS OLDENDORF AND USS MILIUS)

Critique of Onboard Training

Name:______________________________ Date:

Rank/Rate:_______________ Command:_______________

Watch Position:_____________________________________

Using the number system below, place an X in the box that indicates your agreement with the statement listed:

- **N – Not Applicable**
- **1 - Strongly Disagree (unsatisfactory)**
- **2 – Disagree (Lacking /Marginal)**
- **3 – Agree (Satisfactory)**
- **4 – Strongly Agree (On the mark/Very good)**

		N	1	2	3	4
	Scenario					
1	Were the scenarios realistic?					
2	Did the volume of tracks provide a realistic and challenging environment?					
3	Did the scenarios provide an opportunity for the training need by you or your ship?					
4	Where the disclosures adequate to maintain situational awareness?					
5	Where the disclosures made in a timely manner?					
6	Was the information provided in the scenario binder sufficient to conduct training?					
	Training Liaison Officer					
7	Did the Training Liaison Officer provide assistance in a timely manner?					

We would appreciate comments with recommendations below for any items 1 or 2.
Please provide comments below on anything or anyone that you feel are noteworthy.
Fleet Combat is committed to your success in your assignment. Your constructive input will help us improve the product.

COMMENTS/SUGGESTIONS:

____

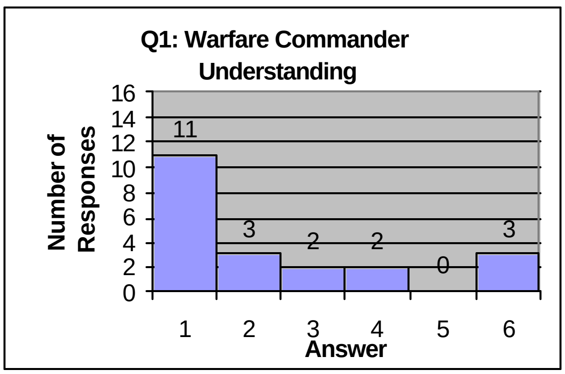
You <u>are not</u> required to put your name on this form; however for personal feedback and to help us make the necessary corrections or provide deserved recognition, a name is helpful and encouraged.

THIS PAGE INTENTIONALLY LEFT BLANK

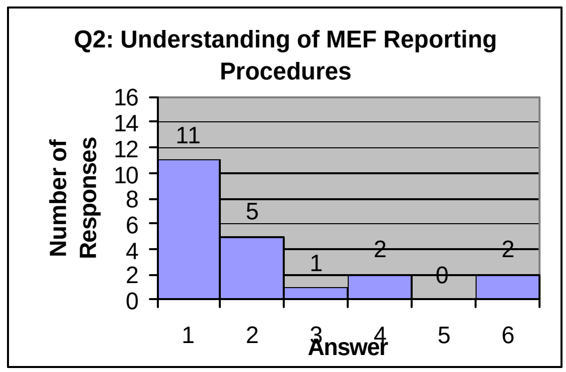
APPENDIX D. MIDDLE EAST FORCE TEAM TRAINER THESIS SPECIFIC SURVEY RESULTS (PEOPLE ON TRAINING TEAM)

This appendix contains the data from the thesis specific survey conducted on the USS FORD and USS RUSSELL following completion of the MIDDLE EAST FORCE Team Trainer in San Diego. The results illustrate the distribution of all survey responses in total and are not separated by target group.

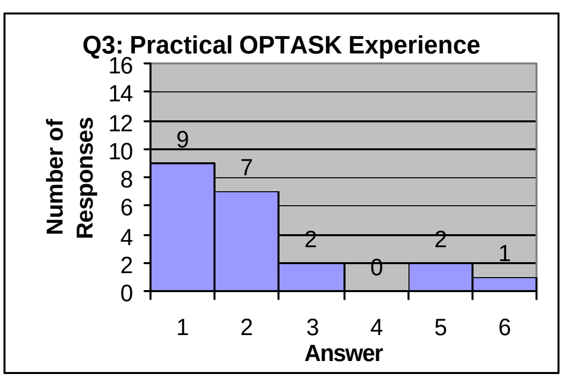
Answer 1 = Strongly Agree, 2 = Mildly Agree, 3 = Undecided, 4 = Mildly Disagree, 5 = Strongly Disagree, 6 = Not Applicable to Me/Don't Know



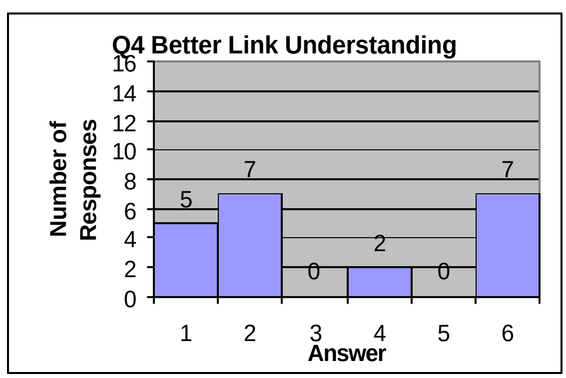
AVG Q1	Mode	STD Dev	Var
2.33	1.00	1.83	3.33



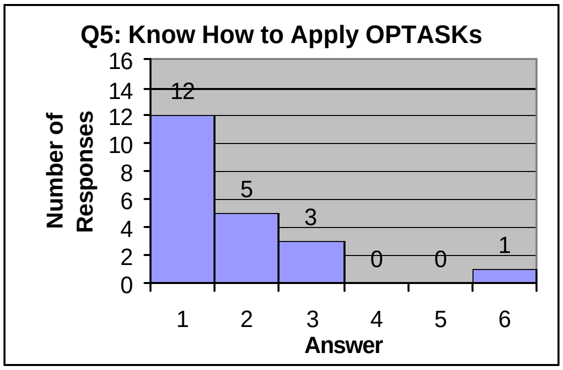
AVG Q2	Mode	STD Dev	Var
2.10	1.00	1.61	2.59



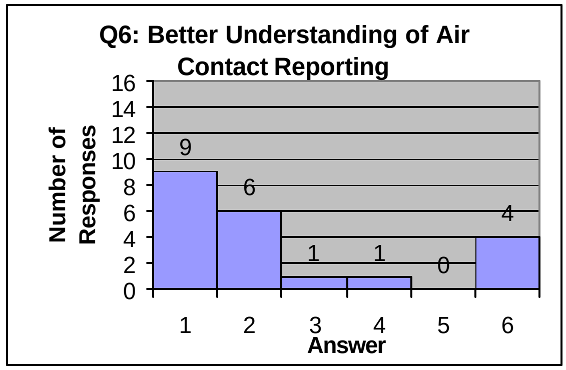
AVG Q3	Mode	STD Dev	Var
2.14	1.00	1.49	2.23



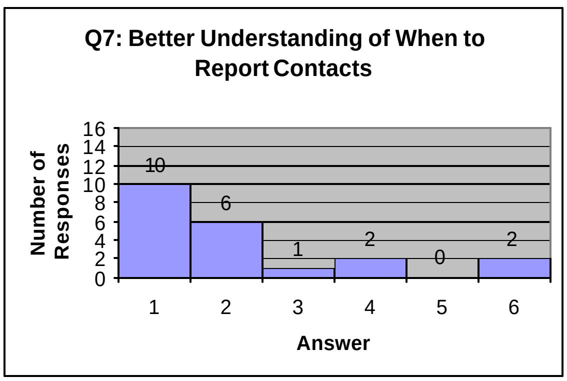
AVG Q4	Mode	STD Dev	Var
3.29	2.00	2.12	4.51



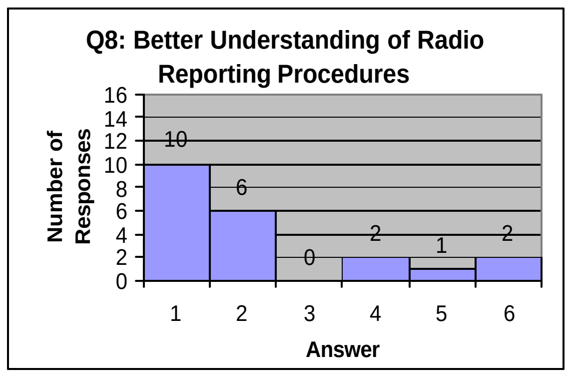
AVG Q5	Mode	STD Dev	Var
1.76	1.00	1.22	1.49



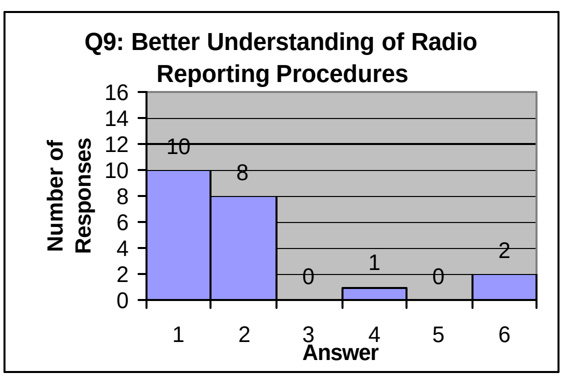
AVG Q6	Mode	STD Dev	Var
2.48	1.00	1.91	3.66



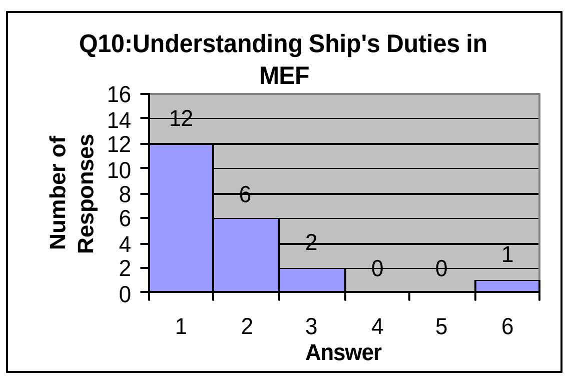
AVG Q7	Mode	STD Dev	Var
2.14	1.00	1.59	2.53



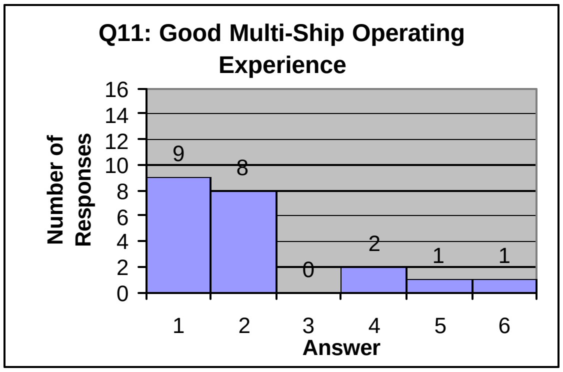
AVG Q8	Mode	STD Dev	Var
2.24	1.00	1.70	2.89

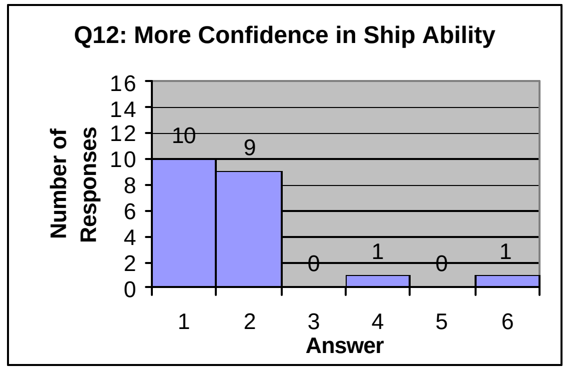


AVG Q9	Mode	STD Dev	Var
2.00	1.00	1.52	2.30



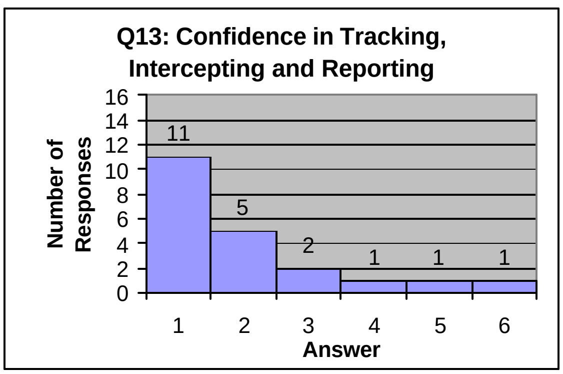
AVG Q10	Mode	STD Dev	Var
1.71	1.00	1.19	1.41

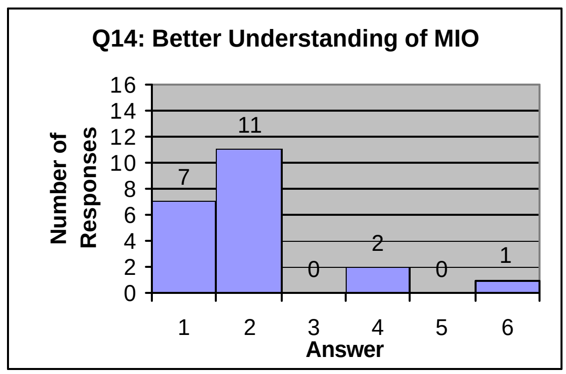




AVG Q11	Mode	STD Dev	Var
2.10	1.00	1.45	2.09

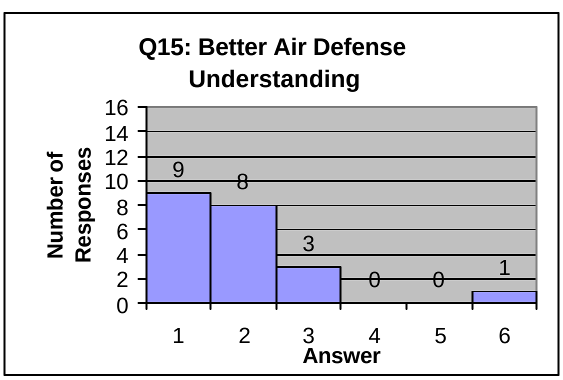
AVG Q12	Mode	STD Dev	Var
1.81	1.00	1.21	1.46

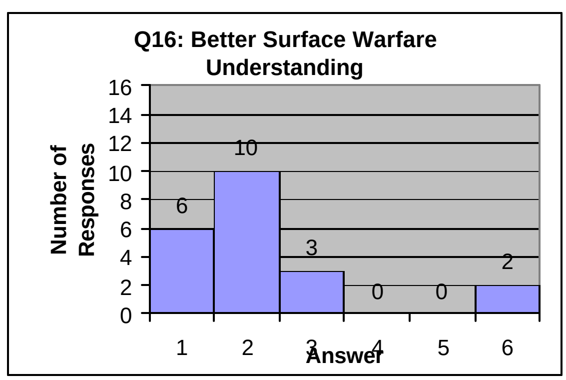




AVG Q13	Mode	STD Dev	Var
2	1	1.45	2.1

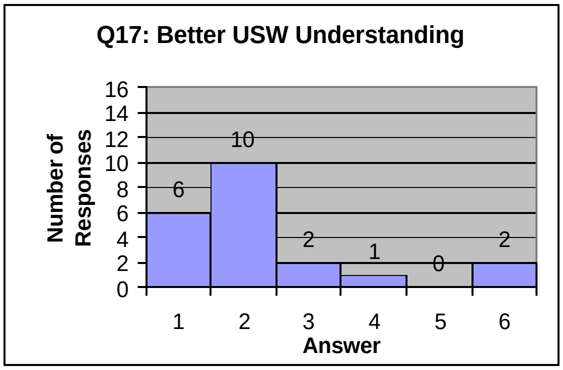
AVG Q14	Mode	STD Dev	Var
2.05	2.00	1.24	1.55

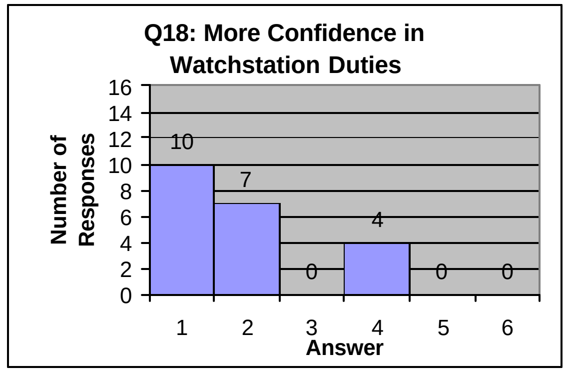




AVG Q15	Mode	STD Dev	Var
1.90	1.00	1.18	1.39

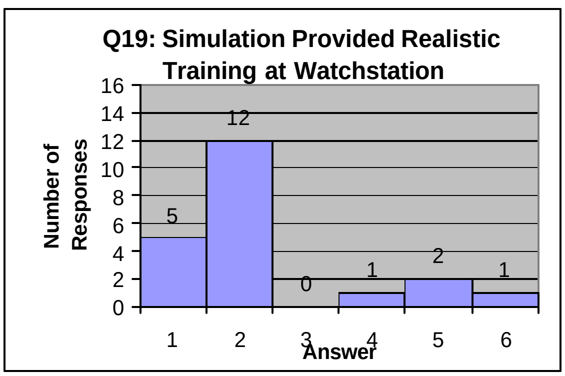
AVG Q16	Mode	STD Dev	Var
2.24	2.00	1.41	1.99

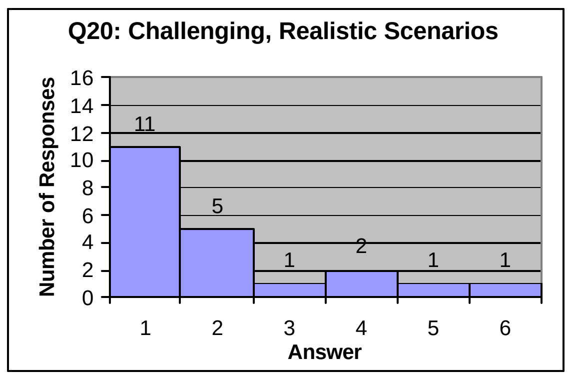




AVG Q17	Mode	STD Dev	Var
2.29	2.00	1.45	2.11

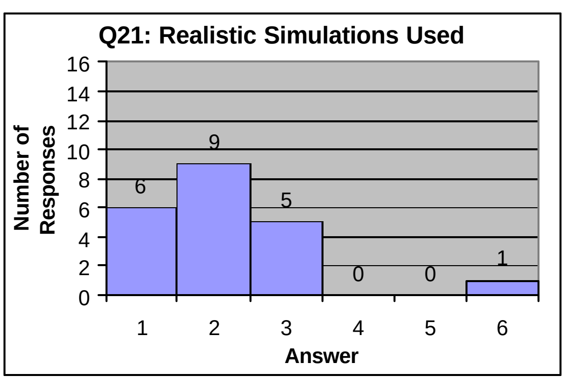
AVG Q18	Mode	STD Dev	Var
1.90	1.00	1.14	1.29

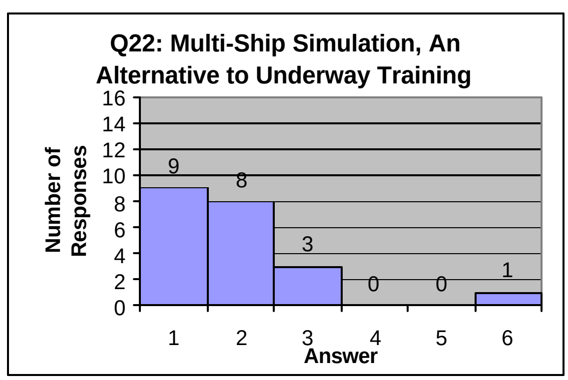




AVG Q19	Mode	STD Dev	Var
2.33	2.00	1.43	2.03

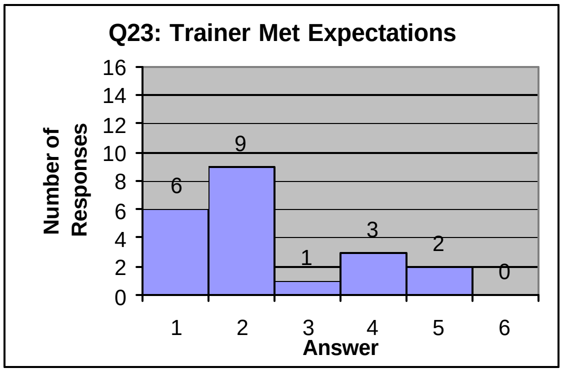
AVG Q20	Mode	STD Dev	Var
2.05	1.00	1.50	2.25

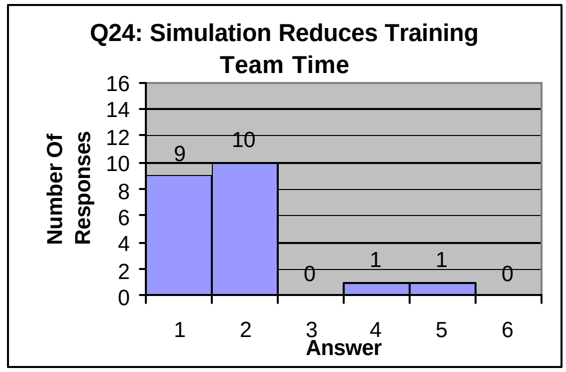




AVG Q21	Mode	STD Dev	Var
2.14	2.00	1.15	1.33

AVG Q22	Mode	STD Dev	Var
1.90	1.00	1.18	1.39





AVG Q23	Mode	STD Dev	Var
2.33	2.00	1.32	1.73

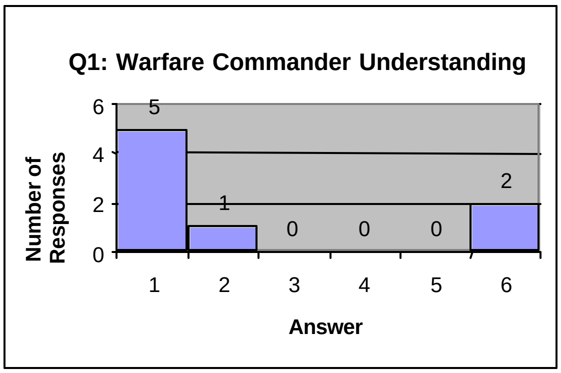
AVG Q24	Mode	STD Dev	Var
1.81	2.00	1.03	1.06

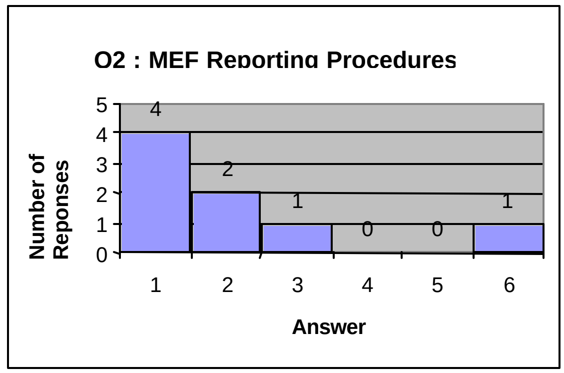
THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX E. MIDDLE EAST FORCE TEAM TRAINER SURVEY RESULTS. THESIS SPECIFIC SURVEY FOR USS RUSSEL AND USS FORD (NON TRAINING TEAM MEMBER)

This appendix contains the data from the thesis specific survey conducted on the USS FORD and USS RUSSELL following completion of the MEF Team Trainer in San Diego. The results illustrate the distribution of all survey responses from people who are not training team members. This information is compared to the distribution of answers for training team members to determine if there is a difference of opinion between training team and non-training team members.

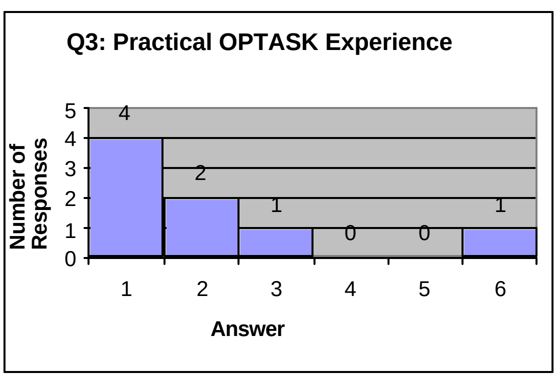
Answer 1= Strongly Agree, 2 = Mildly Agree, 3 = Undecided, 4 = Mildly Disagree, 5 = Strongly Disagree, 6 = Not Applicable to Me/Don't know.

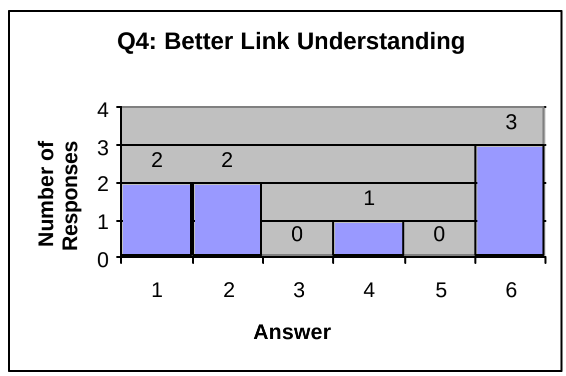




AVG Q1	Mode	STD Dev	Var
2.38	1.00	2.26	5.13

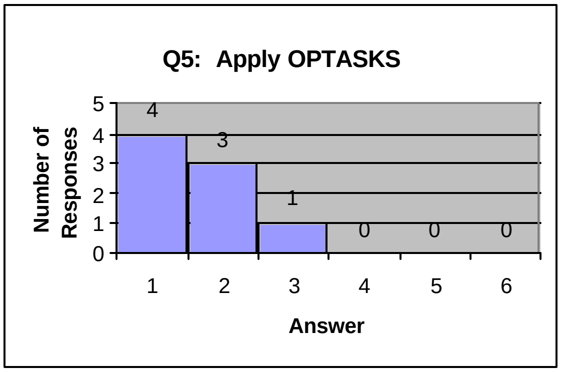
AVG Q2	Mode	STD Dev	Var
2.13	1.00	1.73	2.98

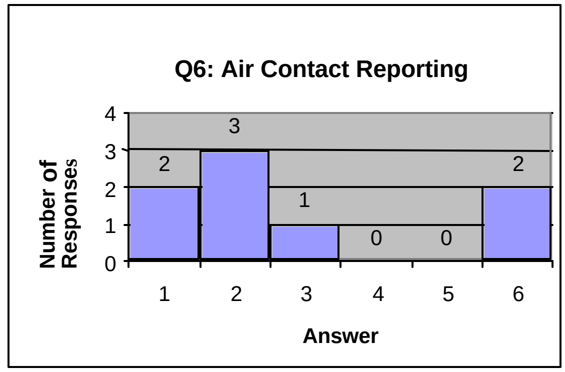




AVG Q3	Mode	STD Dev	Var
1.63	2.00	0.52	0.27

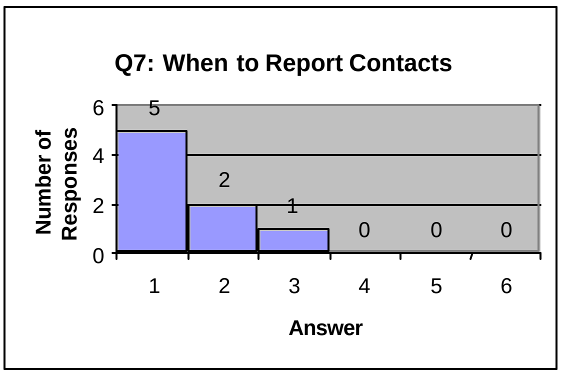
AVG Q4	Mode	STD Dev	Var
3.50	6.00	2.27	5.14

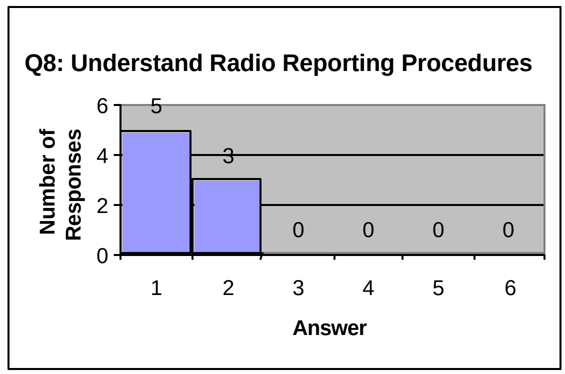




AVG Q5	Mode	STD Dev	Var
1.63	1.00	0.74	0.55

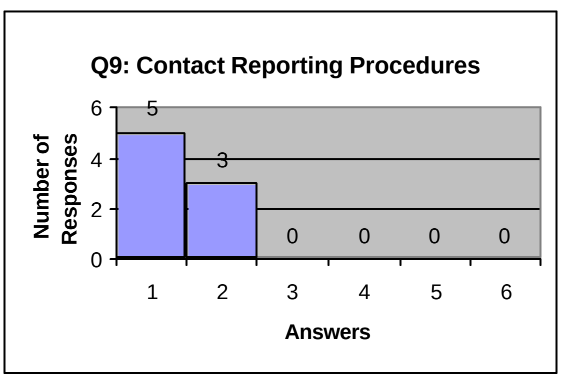
AVG Q6	Mode	STD Dev	Var
2.88	2.00	2.03	4.13

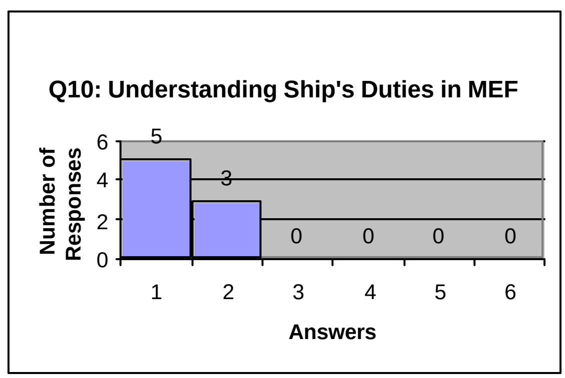




AVG Q7	Mode	STD Dev	Var
1.50	1.00	0.76	0.57

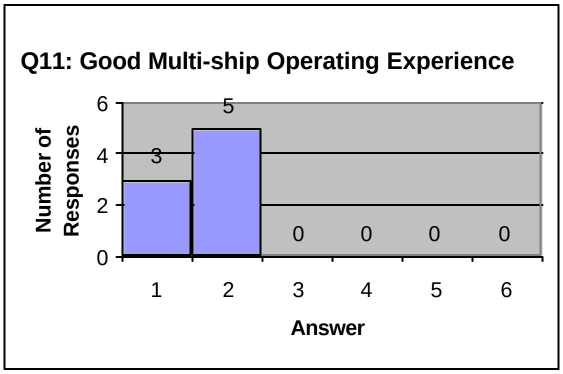
AVG Q8	Mode	STD Dev	Var
1.38	1.00	0.52	0.27



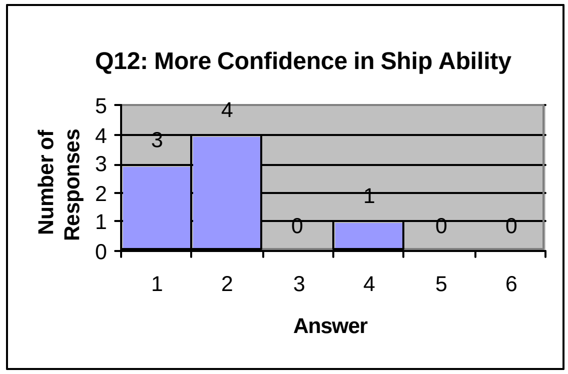


AVG Q9	Mode	STD Dev	Var
1.38	1.00	0.52	0.27

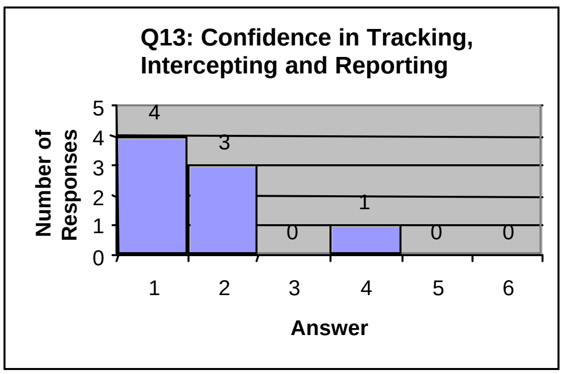
AVG Q10	Mode	STD Dev	Var
1.38	1.00	0.52	0.27



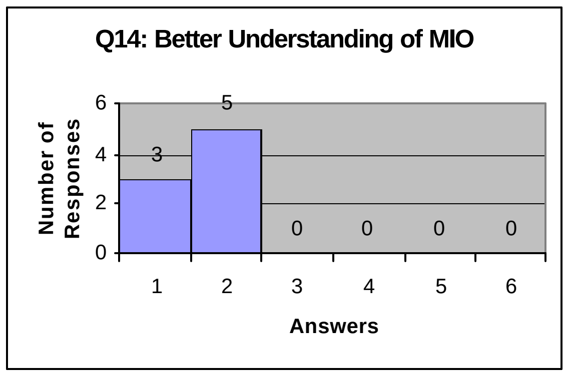
AVG Q11	Mode	STD Dev	Var
1.63	2.00	0.52	0.27



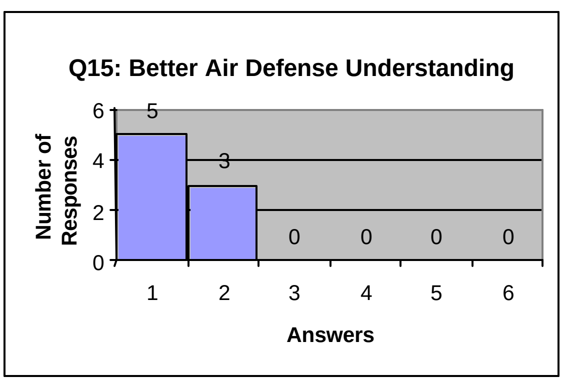
AVG Q12	Mode	STD Dev	Var
1.88	2.00	0.99	0.98



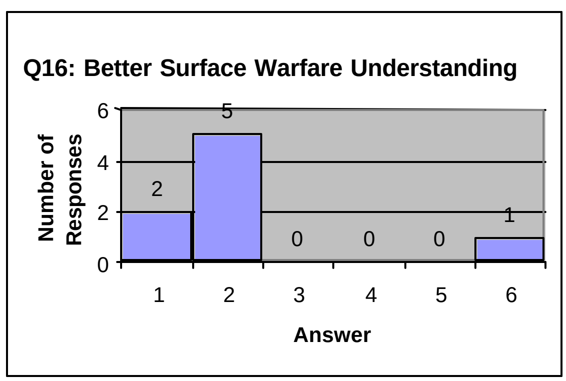
AVG Q13	Mode	STD Dev	Var
1.75	1.00	1.04	1.07



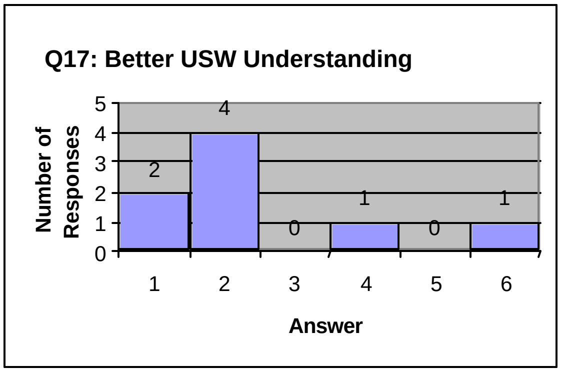
AVG Q14	Mode	STD Dev	Var
1.63	2.00	0.52	0.27

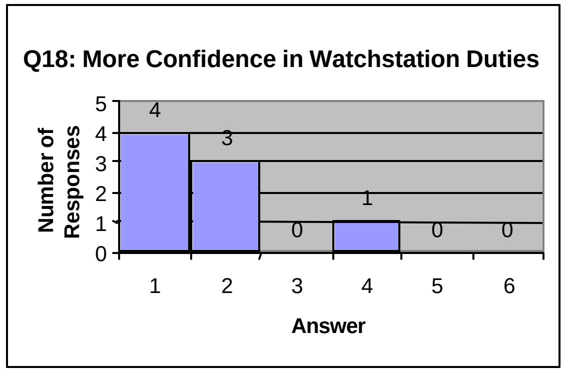


AVG Q15	Mode	STD Dev	Var
1.38	1.00	0.52	0.27



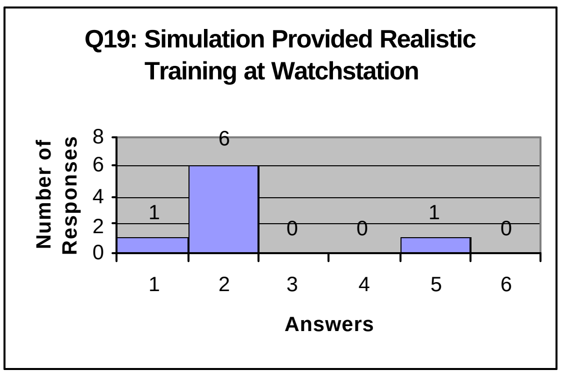
AVG Q16	Mode	STD Dev	Var
2.25	2.00	1.58	2.50

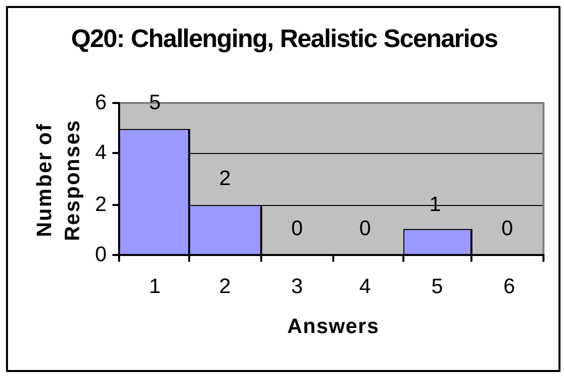




AVG Q17	Mode	STD Dev	Var
2.50	2.00	1.69	2.86

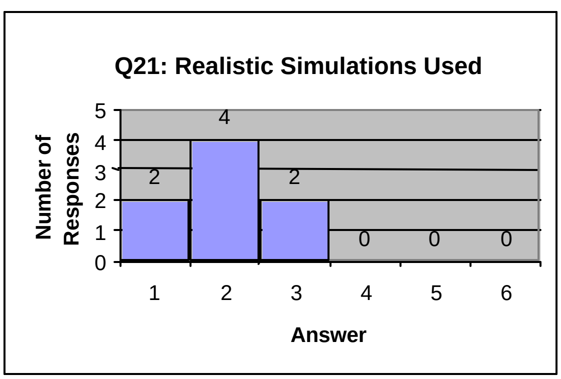
AVG Q18	Mode	STD Dev	Var
1.75	1.00	1.04	1.07

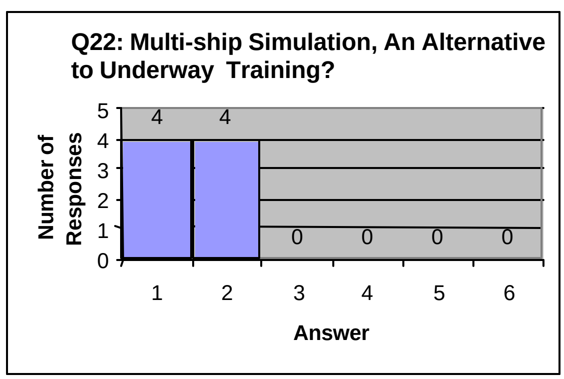




AVG Q19	Mode	STD Dev	Var
2.25	2.00	1.16	1.36

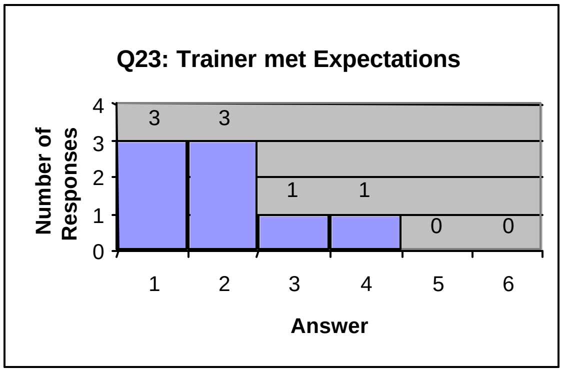
AVG Q20	Mode	STD Dev	Var
1.75	1.00	1.39	1.93

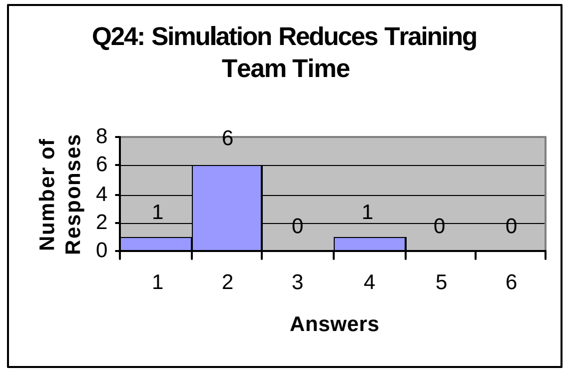




AVG Q21	Mode	STD Dev	Var
2.00	2.00	0.76	0.57

AVG Q22	Mode	STD Dev	Var
1.50	2.00	0.53	0.29





AVG Q23	Mode	STD Dev	Var
2.00	1.00	1.07	1.14

AVG Q24	Mode	STD Dev	Var
2.13	2	0.83452	0.696

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX F. MIDDLE EAST FORCE TEAM TRAINER SURVEY RESULTS. THESIS SPECIFIC SURVEY FOR USS RUSSEL AND USS FORD E-4 THROUGH E-6

This appendix contains the data from the thesis specific survey conducted on the USS FORD and USS RUSSELL following completion of the MEF Team Trainer in San Diego. The results illustrate the distribution of all survey responses from the rank of E-4 to E-6. Numbered questions from the survey are sorted in the columns. Each row indicates a different person's response to each question for this survey. The statistical data for each question is listed below the survey responses.

Answer 1= Strongly Agree, 2 = Mildly Agree, 3 = Undecided, 4 = Mildly Disagree, 5 = Strongly Disagree, 6 = Not Applicable to Me/Don't know.

	Ques1	Ques2	Ques3	Ques4	Ques5	Ques6	Ques7	Ques8
Person 1	1	1	1	1	2	1	1	1
Person 2	1	2	2	1	2	2	2	2
Person 3	2	2	2	2	1	2	2	2
Person 4	6	6	6	6	6	6	6	6
Person 5	1	3	1	6	3	3	3	1
Person 6	4	4	5	6	1	1	4	5
Person 7	6	6	2	6	1	6	1	1
Person 8	1	1	2	4	2	2	1	1
Person 9	6	2	2	6	1	6	1	1
Person 10	4	4	5	6	1	1	2	4
Person 11	1	1	1	1	2	1	1	1
Person 12	2	1	2	1	2	2	2	2
Person 13	2	1	2	2	1	2	2	2
AVG	2.85	2.62	2.54	3.69	1.92	2.69	2.15	2.23
MODE	1.00	1.00	2.00	6.00	1.00	2.00	2.00	1.00
STD DEV	2.08	1.85	1.66	2.36	1.38	1.97	1.46	1.69
VAR	4.31	3.42	2.77	5.56	1.91	3.90	2.14	2.86
AVG of Responders	2.08	1.85	1.66	2.36	1.38	1.97	1.46	1.69

	Ques9	Ques10	Ques11	Ques12	Ques13	Ques14	Ques15	Ques16
Person 1	1	1	1	2	1	1	1	1
Person 2	2	2	2	2	2	2	2	2
Person 3	2	1	1	1	2	2	2	2
Person 4	6	6	6	6	6	6	6	6
Person 5	2	1	2	4	4	1	2	6
Person 6	2	2	5	1	5	2	2	2
Person 7	1	1	1	1	1	1	1	1
Person 8	2	1	1	1	2	2	1	2
Person 9	1	1	2	2	1	1	1	1
Person 10	2	2	4	1	3	2	2	2
Person 11	1	1	2	1	2	1	1	1
Person 12	1	2	1	2	2	2	2	2
Person 13	2	1	1	1	3	2	3	3
AVG	1.92	1.69	2.23	1.92	2.62	1.92	2.00	2.38
MODE	2.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00
STD DEV	1.32	1.38	1.69	1.50	1.56	1.32	1.35	1.71
VAR	1.74	1.90	2.86	2.24	2.42	1.74	1.83	2.92
AVG of Responders	1.32	1.38	1.69	1.50	1.56	1.32	1.35	1.71

	Ques17	Ques18	Ques19	Ques20	Ques21	Ques22
Person 1	1	2	2	1	1	1
Person 2	2	2	2	2	2	2
Person 3	2	1	1	4	3	2
Person 4	6	1	6	6	6	6
Person 5	6	4	5	5	3	2
Person 6	2	4	5	4	3	3
Person 7	1	1	1	1	1	1
Person 8	4	2	2	1	2	1
Person 9	1	2	2	1	3	1
Person 10	2	2	4	3	2	3
Person 11	1	2	2	1	1	1
Person 12	2	1	2	1	2	2
Person 13	2	1	1	2	3	1
AVG	2.46	1.92	2.69	2.46	2.46	2.00
MODE	2.00	2.00	2.00	1.00	3.00	1.00
STD DEV	1.76	1.04	1.70	1.76	1.33	1.41
VAR	3.10	1.08	2.90	3.10	1.77	2.00
AVG of Responders	1.76	1.04	1.70	1.76	1.33	1.41

	Question 23	Question 24
Person 1	1	1
Person 2	1	2
Person 3	2	1
Person 4	6	5
Person 5	4	2
Person 6	5	2
Person 7	1	4
Person 8	3	2
Person 9	1	1
Person 10	4	2
Person 11	2	1
Person 12	2	2
Person 13	2	1
AVG	2.62	2.00
MODE	2.00	2.00
STD DEV	1.66	1.22
VAR	2.76	1.50
AVG of Responders	1.66	1.22

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX G. MIDDLE EAST FORCE TEAM TRAINER SURVEY RESULTS. THESIS SPECIFIC SURVEY FOR USS RUSSEL AND USS FORD E-7 THROUGH E-9

This appendix contains the data from the thesis specific survey conducted on the USS FORD and USS RUSSELL following completion of the MEF Team Trainer in San Diego. The results illustrate the distribution of all survey responses from the rank of E-7 to E-9. Numbered questions from the survey are sorted in the columns. Each row indicates a different person's response to each question for this survey. The statistical data for each question is listed below the survey responses.

Answer 1= Strongly Agree, 2 = Mildly Agree, 3 = Undecided, 4 = Mildly Disagree, 5 = Strongly Disagree, 6 = Not Applicable to Me/Don't know.

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8
Person 1	1	1	1	1	1	1	1	1
Person 2	3	2	3	4	3	4	4	4
Person 3	1	1	1	6	1	2	2	2
Person 4	3	2	3	2	3	6	6	6
AVG	2.00	1.50	2.00	3.25	2.00	3.25	3.25	3.25
MODE	1.00	1.00	1.00	#N/A	1.00	#N/A	#N/A	#N/A
STD DEV	1.15	0.58	1.15	2.22	1.15	2.22	2.22	2.22
VAR	1.33	0.33	1.33	4.92	1.33	4.92	4.92	4.92

	Question 9	Question 10	Question 11	Question 12	Question 13	Question 14	Question 15
Person 1	1	1	1	1	1	1	1
Person 2	4	3	4	2	1	4	3
Person 3	2	1	1	1	1	1	1
Person 4	6	3	2	2	1	4	3
AVG	3.25	2.00	2.00	1.50	1.00	2.50	2.00
MODE	#N/A	1.00	1.00	1.00	1.00	1.00	1.00
STD DEV	2.22	1.15	1.41	0.58	0.00	1.73	1.15
VAR	4.92	1.33	2.00	0.33	0.00	3.00	1.33

	Question 16	Question 17	Question 18	Question 19	Question 20	Question 21	Question 22
Person 1	1	1	1	1	1	1	1
Person 2	3	3	4	2	2	2	3
Person 3	1	1	1	1	1	1	1
Person 4	3	3	4	2	1	2	2
AVG	2.00	2.00	2.50	1.50	1.25	1.50	1.75
MODE	1.00	1.00	1.00	1.00	1.00	1.00	1.00
STD DEV	1.15	1.15	1.73	0.58	0.50	0.58	0.96
VAR	1.33	1.33	3.00	0.33	0.25	0.33	0.92

Appendix G (Cont.)

Answer 1= Strongly Agree, 2 = Mildly Agree, 3 = Undecided, 4 = Mildly Disagree, 5 = Strongly Disagree, 6 = Not Applicable to Me/Don't know.

	Question 23	Question 24	Question 25	Question 26	Question 27
Person 1	1	2	3	1	1
Person 2	5	1	3	1	1
Person 3	1	2	3	1	1
Person 4	4	1	3	1	1
AVG	2.75	1.50	3.00	1.00	1.00
MODE	1.00	2.00	3.00	1.00	1.00
STD DEV	2.06	0.58	0.00	0.00	0.00
VAR	4.25	0.33	0.00	0.00	0.00

APPENDIX H. MIDDLE EAST FORCE TEAM TRAINER SURVEY RESULTS. THESIS SPECIFIC SURVEY FOR USS RUSSEL AND USS FORD O-1 THROUGH O-3

This appendix contains the data from the thesis specific survey conducted on the USS FORD and USS RUSSELL following completion of the MEF Team Trainer in San Diego. The results illustrate the distribution of all survey responses from the rank of O-1 to O-3. Numbered questions from the survey are sorted in the columns. Each row indicates a different person's response to each question for this survey. The statistical data for each question is listed below the survey responses.

Answer 1= Strongly Agree, 2 = Mildly Agree, 3 = Undecided, 4 = Mildly Disagree, 5 = Strongly Disagree, 6 = Not Applicable to Me/Don't know.

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8
Person 1	1	1	1	2	1	1	1	1
Person 2	1	1	1	2	1	1	1	1
Person 3	1	1	1	2	1	1	1	2
Person 4	1	1	1	2	1	1	1	1
AVG	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.25
MODE	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00
STD DEV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
VAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25

	Question 9	Question 10	Question 11	Question 12	Question 13	Question 14	Question 15
Person 1	1	2	2	2	1	2	2
Person 2	1	2	2	2	1	2	1
Person 3	1	1	2	1	1	2	1
Person 4	1	1	1	2	1	2	2
AVG	1.00	1.50	1.75	1.75	1.00	2.00	1.50
MODE	1.00	2.00	2.00	2.00	1.00	2.00	2.00
STD DEV	0.00	0.58	0.50	0.50	0.00	0.00	0.58
VAR	0.00	0.33	0.25	0.25	0.00	0.00	0.33

	Question 16	Question 17	Question 18	Question 19	Question 20	Question 21	Question 22
Person 1	2	2	1	2	2	2	2
Person 2	2	2	1	2	2	2	2
Person 3	2	2	1	2	1	1	1
Person 4	2	2	2	2	1	2	2
AVG	2.00	2.00	1.25	2.00	1.50	1.75	1.75
MODE	2.00	2.00	1.00	2.00	2.00	2.00	2.00
STD DEV	0.00	0.00	0.50	0.00	0.58	0.50	0.50
VAR	0.00	0.00	0.25	0.00	0.33	0.25	0.25

Appendix H (Cont.)

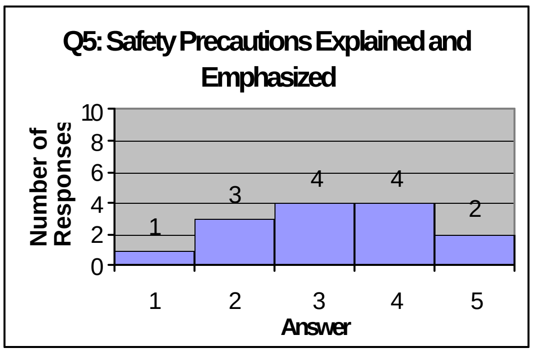
Answer 1= Strongly Agree, 2 = Mildly Agree, 3 = Undecided, 4 = Mildly Disagree,
5 = Strongly Disagree, 6 = Not Applicable to Me/Don't know.

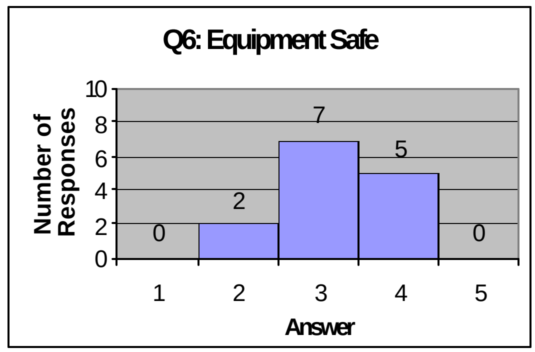
	Question 23	Question 24	Question 25	Question 26	Question 27
Person 1	2	1	4	1	1
Person 2	2	2	4	2	2
Person 3	2	2	4	2	2
Person 4	2	1	4	1	1
AVG	2.00	1.50	4.00	1.50	1.50
MODE	2.00	1.00	4.00	1.00	1.00
STD DEV	0.00	0.58	0.00	0.58	0.58
VAR	0.00	0.33	0.00	0.33	0.33

APPENDIX I. MIDDLE EAST FORCE TEAM TRAINER SURVEY RESULTS (USS OLDENDORF AND CDS 23 IN MOCKUP AT FCTCPAC)

This appendix contains the data from the FCTCPAC survey from the USS OLDENDORF and COMDESRON 23 MEF Team Trainer after they participated in the mockup at FCTCPAC, San Diego. The results include all survey responses in total and are not separated by target group. The graphs illustrate the distribution of answer for all surveys received by FCTCPAC.

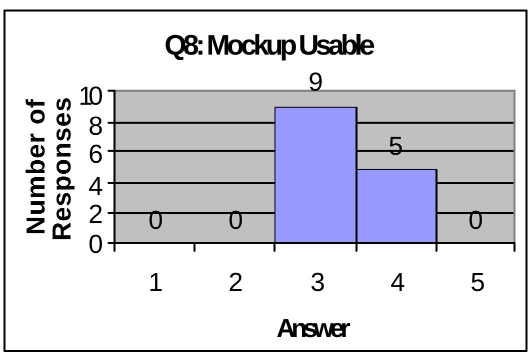
Answer 1= Strongly Disagree, 2 = Disagree, 3 = Agree
4 = Strongly Agree, 5 = Not Applicable

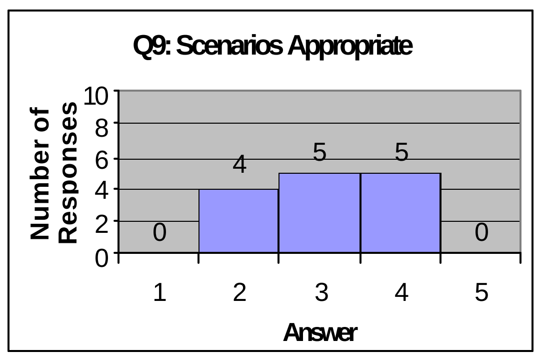




AVG Q5	MODE	STD DEV	VAR
2.5	4	1.400549	1.961538

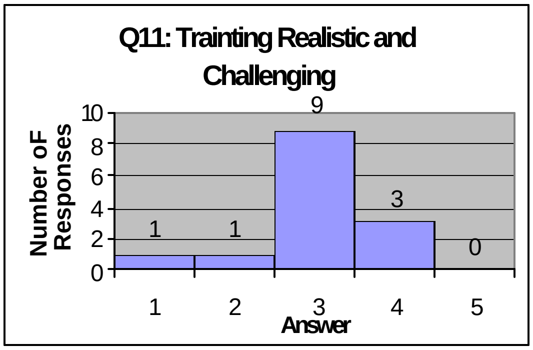
AVG Q6	MODE	STD DEV	VAR
3.214286	3	0.699293	0.489011



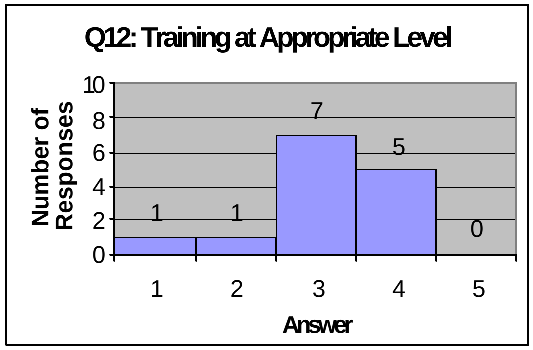


AVG Q8	MODE	STD DEV	VAR
3.357143	3	0.497245	0.247253

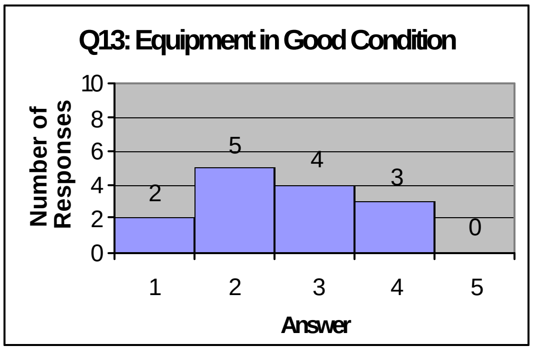
AVG Q9	MODE	STD DEV	VAR
3.071429	4	0.828742	0.686813



AVG Q11	MODE	STD DEV	VAR
3	3	0.784465	0.615385



AVG Q12	MODE	STD DEV	VAR
3.142857	3	0.864438	0.747253

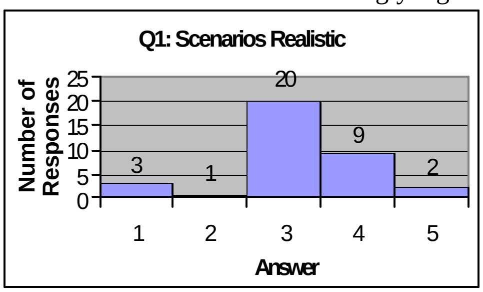


AVG 13	MODE	STD DEV	VAR
2.571429	2	1.01635	1.032967

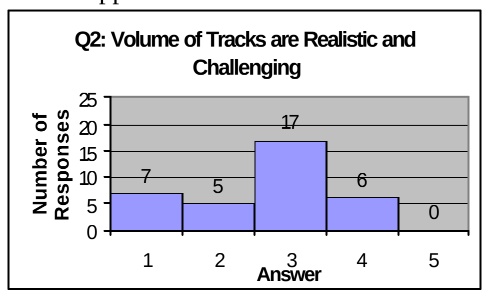
APENDIX J. RESULTS FROM FCTCPAC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER WITH USS MILLIUS AND USS OLDENDORF

This appendix contains the data from the survey conducted by FCTCPAC on the USS MILLIUS and USS OLDENDORF following completion of the distributed MEF Team Trainer in San Diego. The results illustrate the distribution of all survey responses and are not separated by target group.

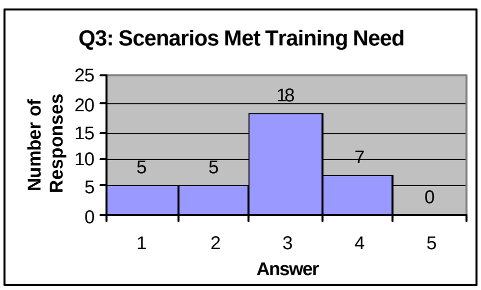
Answer 1= Strongly Disagree, 2 = Disagree, 3 = Agree
4 = Strongly Agree, 5 = Not Applicable



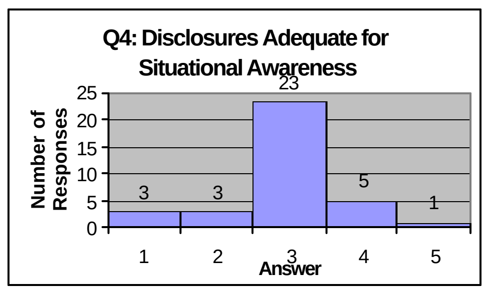
AVG Q1	MODE	STD DEV	VAR
2.89	3.00	1.08	1.16



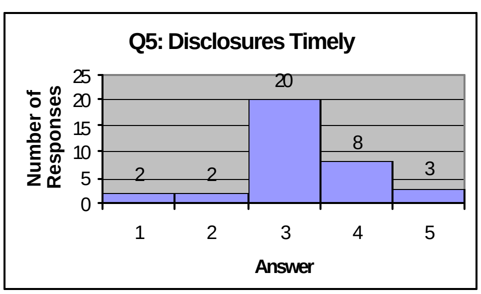
AVG Q2	MODE	STD DEV	VAR
2.63	3.00	1.00	1.01



AVG Q3	MODE	STD DEV	VAR
2.77	3.00	0.94	0.89



AVG Q4	MODE	STD DEV	VAR
2.80	3.00	0.90	0.81



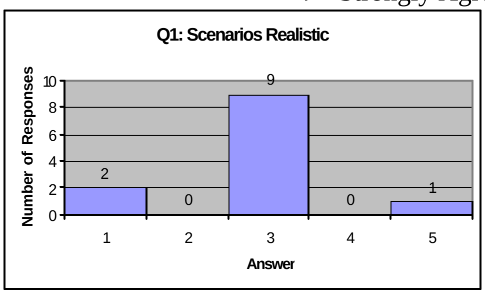
AVG Q5	MODE	STD DEV	VAR
2.80	3.00	1.13	1.28

THIS PAGE INTENTIONALLY LEFT BLANK

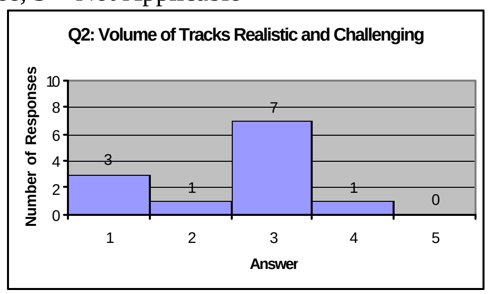
APPENDIX K. RESULTS FROM FCTCPAC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER WITH USS MILLIUS AND USS OLDENDORF RESPONSES FROM E-4 TO E-6

This appendix contains the data from the survey conducted by FCTCPAC on the USS OLDENDORF and USS MILIUS following completion of the distributed MEF Team Trainer, in San Diego. These graphs illustrate survey responses received from E-4 through E-6.

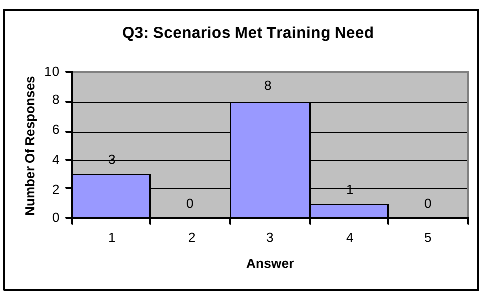
Answer 1= Strongly Disagree, 2 = Disagree, 3 = Agree
4 = Strongly Agree, 5 = Not Applicable



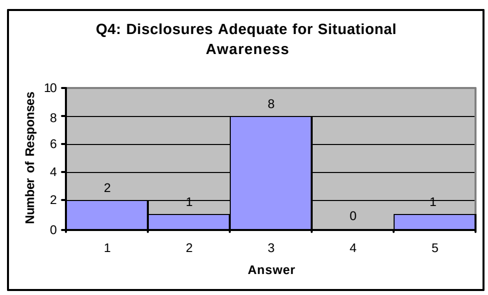
AVG Q1	MODE	STD DEV	VAR
2.89	3.00	1.08	1.16



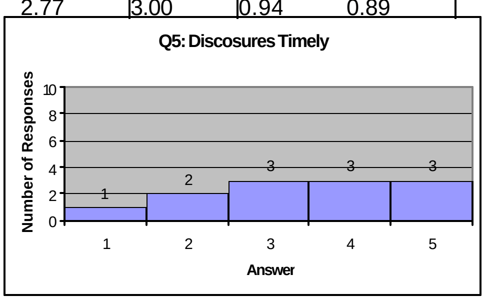
AVG Q2	MODE	STD DEV	VAR
2.63	3.00	1.00	1.01



AVG Q3	MODE	STD DEV	VAR
2.77	3.00	0.94	0.89



AVG Q4	MODE	STD DEV	VAR
2.80	3.00	0.90	0.81



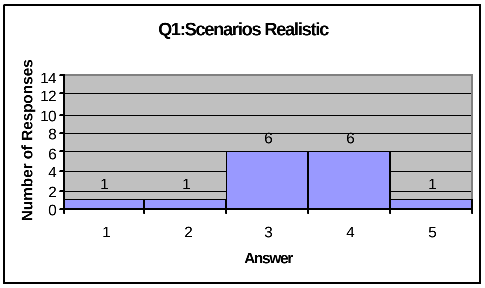
AVG Q5	MODE	STD DEV	VAR
2.80	3.00	1.13	1.28

THIS PAGE INTENTIONALLY LEFT BLANK

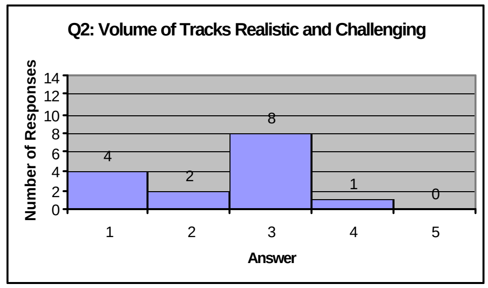
APPENDIX L. RESULTS FROM FCTCPAC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER WITH USS MILLIUS AND USS OLDENDORF RESPONSES FROM E-7 - E-9

This appendix contains the data from the survey conducted by on the USS OLDENDORF and USS MILIUS following completion of the distributed MEF Team Trainer in San Diego. These graphs illustrate survey responses received E-7 through E-9.

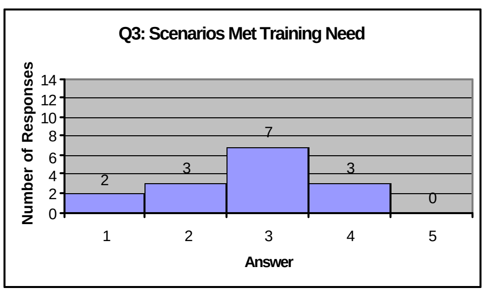
Answer 1= Strongly Disagree, 2 = Disagree, 3 = Agree
4 = Strongly Agree, 5 = Not Applicable



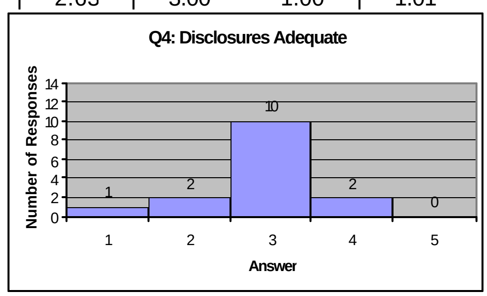
AVG Q1	MODE	STD DEV	VAR
2.89	3.00	1.08	1.16



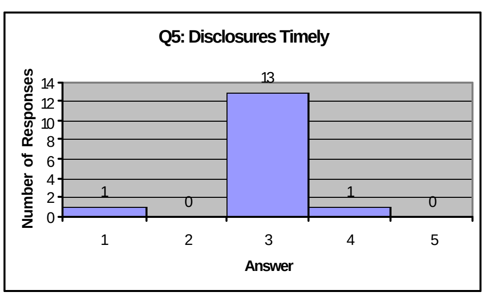
AVG Q2	MODE	STD DEV	VAR
2.63	3.00	1.00	1.01



AVG Q3	MODE	STD DEV	VAR
2.77	3.00	0.94	0.89



AVG Q4	MODE	STD DEV	VAR
2.80	3.00	0.90	0.81



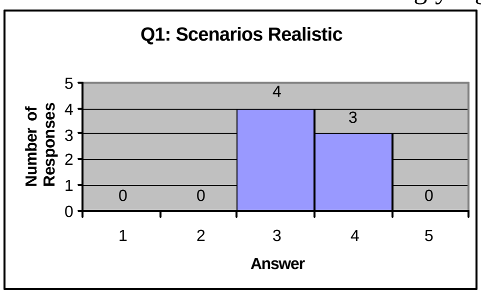
AVG Q5	MODE	STD DEV	VAR
2.80	3.00	1.13	1.28

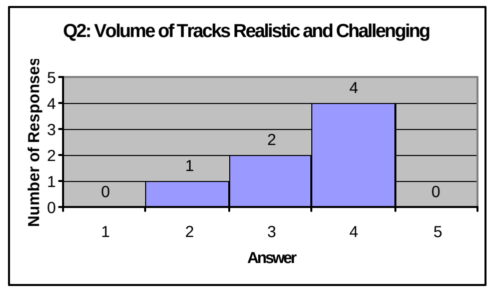
THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX M. RESULTS FROM FCTCPAC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER WITH USS MILLIUS AND USS OLDENDORF RESPONSES FROM O-1 - O-3

This appendix contains the data from the survey conducted by FCTCPAC on the USS OLDENDORF and USS MILIUS following completion of the distributed MEF Team Trainer in San Diego. These graphs illustrate survey responses received from O-1 through O-3.

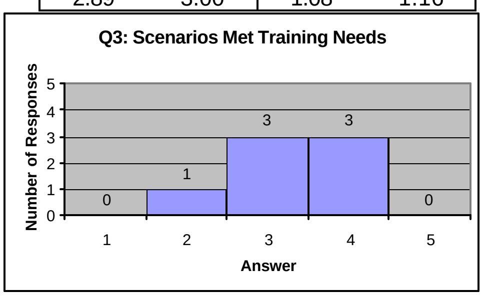
Answer 1= Strongly Disagree, 2 = Disagree, 3 = Agree
4 = Strongly Agree, 5 = Not Applicable

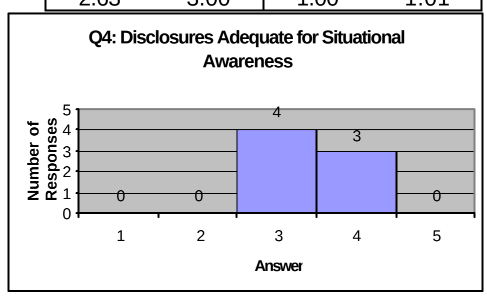




AVG Q1	MODE	STD DEV	VAR
2.89	3.00	1.08	1.16

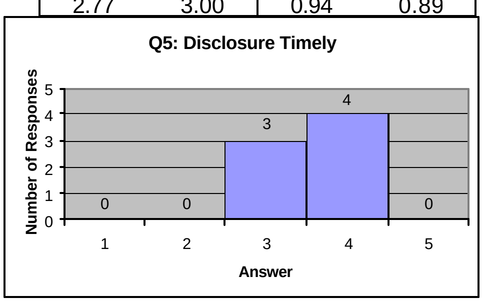
AVG Q2	MODE	STD DEV	VAR
2.63	3.00	1.00	1.01





AVG Q3	MODE	STD DEV	VAR
2.77	3.00	0.94	0.89

AVG Q4	MODE	STD DEV	VAR
2.80	3.00	0.90	0.81



AVG Q5	MODE	STD DEV	VAR
2.80	3.00	1.13	1.28

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX N. REGRESSION DATA FROM THESIS SPECIFIC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER (USS RUSSEL AND USS FORD)

This appendix contains the regression data from the survey conducted on the USS RUSSEL and USS FORD following completion of the MEF Team Trainer that was simulated onboard the ship using TACDEW. The first analysis was to determine which factors influenced a sailor's understanding of OPTASKS. The second analysis helped determine which factors influenced a sailor's understanding of MEF reporting procedures. The final analysis helped determine which factors influenced a sailor's understanding of MIO operations.

Regression Analysis: Ques5 (Understanding how to Apply OPTASKs**) versus Ques12 (**More Confidence in Ship Ability**), Ques21 (**Realistic Simulations Used**), Ques16 (**Better Surface Warfare Understanding**), Ques15 (**Better Air Defense Understanding**), Ques17 (**Better USW Understanding**)**

```
The regression equation is
Ques5 = 0.053 + 0.642 Ques12 - 0.443 Ques21 - 0.662 Ques16 + 0.735 Ques15
           + 0.691 Ques17

Predictor         Coef     SE Coef          T        P
Constant        0.0530      0.2290       0.23    0.820
Ques12          0.6419      0.1641       3.91    0.001
Ques21         -0.4435      0.1770      -2.50    0.024
Ques16         -0.6624      0.2789      -2.37    0.031
Ques15          0.7353      0.1826       4.03    0.001
Ques17          0.6911      0.2271       3.04    0.008

S = 0.4775      R-Sq = 88.5%     R-Sq(adj) = 84.7%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         5     26.3901      5.2780     23.15    0.000
Residual Error    15      3.4194      0.2280
Total             20     29.8095

Source       DF      Seq SS
Ques12        1     21.4577
Ques21        1      0.0007
Ques16        1      0.4311
Ques15        1      2.3904
Ques17        1      2.1102

Unusual Observations
Obs     Ques12      Ques5         Fit      SE Fit    Residual    St Resid
  7       4.00      3.000       2.933       0.452       0.067        0.44 X
  8       2.00      1.000       1.978       0.126      -0.978       -2.12R
 12       1.00      2.000       1.983       0.448       0.017        0.10 X
 16       2.00      1.000       1.978       0.126      -0.978       -2.12R
 17       1.00      2.000       1.015       0.155       0.985        2.18R

       R denotes an observation with a large standardized residual
```

```
X denotes an observation whose X value gives it large influence.
```

`MTB >` One of the factors that indicate how well an individual learned to apply OPTASKS was whether that individual feels more confident operating in the MEF/ Task Group, whether the trainer provided realistic simulations, and how the trainer helped them understand the three warfare areas, USW, AW and SUW. Realistic simulations, experience operating in the MEF or Task Group and practical experience in the warfare areas helped trainees better understand and apply their group's OPTASKS. This should be the case since trainees are required to take the taskings and apply them in a stressful environment. This indicates that simulated training may help trainees understand OPTASK before applying them in underway training.

Regression Analysis: Ques2 (Understanding of MEF reporting Procedures**) versus Ques6 (**Understanding Air Contact Reporting**), Ques8 (**Understanding Radio Reporting Procedures**), Ques9 (**Understanding Contact Reporting Procedures**)**

```
The regression equation is
Ques2 = 0.423 + 0.563 Ques6 + 0.815 Ques8 - 0.773 Ques9

Predictor        Coef     SE Coef          T        P
Constant       0.4234      0.5019       0.84    0.411
Ques6          0.5629      0.1860       3.03    0.008
Ques8          0.8152      0.3203       2.55    0.021
Ques9         -0.7733      0.4137      -1.87    0.079

S = 1.215       R-Sq = 51.5%     R-Sq(adj) = 43.0%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         3      26.702       8.901      6.03    0.005
Residual Error    17      25.108       1.477
Total             20      51.810

Source       DF      Seq SS
Ques6         1      16.772
Ques8         1       4.770
Ques9         1       5.160

Unusual Observations
Obs      Ques6     Ques 2         Fit      SE Fit    Residual    St Resid
  4       6.00      6.000       4.052       0.769       1.948       2.07R
 11       6.00      6.000       3.843       0.839       2.157       2.45R
 13       6.00      2.000       3.843       0.839      -1.843      -2.10R
 21       6.00      2.000       4.052       0.769      -2.052      -2.18R

R denotes an observation with a large standardized residual
```

`MTB >` Understanding who to report air contacts to, better understanding Radio Telephone procedures, and understanding ship's reporting responsibilities indicate whether an individual has an understanding the MEF's reporting procedures.

Regression Analysis: Ques14 (Better Understanding of MIO**) versus Ques15 (**Better Air Defense Understanding**), Ques17 (**Better USW Understanding**), Ques10 (**Understanding Ship's Duties in MEF**), Ques12 (**More Confidence in Ship's Ability**)**

```
The regression equation is
Ques14 = 0.237 + 0.367 Ques15 + 0.192 Ques17 + 0.796 Ques10 - 0.383 Ques12

Predictor        Coef     SE Coef          T        P
Constant       0.2374      0.1755       1.35    0.195
Ques15         0.3668      0.1647       2.23    0.041
Ques17        0.19249     0.09942       1.94    0.071
Ques10         0.7964      0.1596       4.99    0.000
Ques12        -0.3833      0.1358      -2.82    0.012

S = 0.3909      R-Sq = 92.1%     R-Sq(adj) = 90.1%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         4     28.5076      7.1269     46.64    0.000
Residual Error    16      2.4447      0.1528
Total             20     30.9524

Source       DF      Seq SS
Ques15        1     24.4866
Ques17        1      0.0119
Ques10        1      2.7917
Ques12        1      1.2174

Unusual Observations
Obs     Ques15     Ques14         Fit      SE Fit    Residual    St Resid
  4       6.00     6.0000      6.0714      0.3466     -0.0714       -0.40 X
  7       2.00     1.0000      1.3891      0.3449     -0.3891       -2.11RX

       R denotes an observation with a large standardized residual
       X denotes an observation whose X value gives it large influence.
```

MTB > Trainees have a better understanding of MIO operations when they are able to apply taskings and understand their duties within the group. Air tactics and sub surface tactics are important skills to learn if they are attempting to learn and understand MIO operations. These four areas should be the focus of MEF Team Trainers according to trainee feedback.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX O. REGRESSION DATA FROM THESIS SPECIFIC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER (USS RUSSEL AND USS FORD) FACTORS THAT INFLUENCE WHETHER AN OPERATOR BELIEVES SIMULATED COMBAT SYSTEMS TRAINING IS AN EFFECTIVE ALTERNATIVE TO UNDERWAY TRAINING

This appendix contains the regression data from the survey conducted on the USS RUSSEL and USS FORD following completion of the MEF Team Trainer that was simulated onboard the ship using TACDEW. This series of regression analyses discusses the factors that influence the operator's perception of whether simulated combat systems training is an effective alternative to underway training.

Regression Analysis: Ques25 (Rank**) versus Ques22 (**Multi-ship Simulation, An Alternative to Underway Training?**)**

```
The regression equation is
Ques25 = 2.70 - 0.067 Ques22

Predictor         Coef     SE Coef          T        P
Constant        2.6986      0.3493       7.73    0.000
Ques22         -0.0668      0.1570      -0.43    0.675

S = 0.8278      R-Sq = 0.9%      R-Sq(adj) = 0.0%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1      0.1240      0.1240      0.18    0.675
Residual Error    19     13.0188      0.6852
Total             20     13.1429

Unusual Observations
Obs     Ques22     Ques25         Fit      SE Fit    Residual    St Resid
  4       6.00      2.000       2.298       0.668      -0.298       -0.61 X

X denotes an observation whose X value gives it large influence.
```

MTB > There appears to be no correlation between rank and how well trainees believe that distributed simulation training substitutes for some underway Combat Systems Training.

Regression Analysis: Ques22 (Multi-Ship Simulation, An Alternative to Underway Training**) versus Quess23 (**Trainer Met Expectations**), Ques21 (**Realistic Simulations Used**)**

```
The regression equation is
Ques22 = - 0.092 + 0.391 Quess23 + 0.471 Ques21

Predictor        Coef     SE Coef          T        P
Constant      -0.0917      0.2917      -0.31    0.757
Quess23        0.3915      0.1123       3.49    0.003
Ques21         0.4707      0.1497       3.14    0.006

S = 0.5972      R-Sq = 76.9%     R-Sq(adj) = 74.3%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      21.389      10.695     29.98    0.000
Residual Error    18       6.421       0.357
Total             20      27.810

Source       DF      Seq SS
Quess23       1      17.862
Ques21        1       3.527

Unusual Observations
```

Obs	Quess23	Ques22	Fit	SE Fit	Residual	St Resid
4	6.00	6.000	5.081	0.466	0.919	2.46RX

R denotes an observation with a large standardized residual
X denotes an observation whose X value gives it large influence.

Durbin-Watson statistic = 2.35

MTB > This is a very important finding. The analysis indicates that there is a strong correlation between whether people think that that the training is realistic AND whether the trainer met expectations. Additionally, the these factors affect people's perception of whether multi-ship simulation could be a realistic alternative to some combat systems underway training. The data suggests the training is realistic and meets expectations and that simulation training is a realistic alternative to underway combat systems training. This indicates that the realism of the simulation is critical to the successful use of simulation as a complement to underway training.

Regression Analysis: Ques22 (Multi-Ship Simulation, An Alternative to Underway Training**) versus Ques15 (**Better Surface Warfare Understanding**), Ques24 (**Simulation Reduces Training Team Time**)**

```
The regression equation is
Ques22 = - 0.008 + 0.772 Ques15 + 0.245 Ques 24

Predictor        Coef     SE Coef         T       P
Constant      -0.0076      0.2982     -0.03   0.980
Ques15         0.7715      0.1227      6.29   0.000
Ques 24        0.2447      0.1404      1.74   0.098

S = 0.5940      R-Sq = 77.2%     R-Sq(adj) = 74.6%

Analysis of Variance

Source           DF          SS          MS         F        P
Regression        2      21.458      10.729     30.40    0.000
Residual Error   18       6.352       0.353
Total            20      27.810

Source       DF      Seq SS
Ques15        1      20.385
Ques24       1       1.073

Unusual Observations
Obs     Ques15     Ques22         Fit      SE Fit    Residual    St Resid
  4       6.00      6.000       5.845       0.540       0.155        0.63 X
 19       3.00      1.000       2.552       0.245      -1.552       -2.87R
```

R denotes an observation with a large standardized residual
X denotes an observation whose X value gives it large influence.

MTB > This indicates that how much people seemed to learn about Air Warfare and Maritime Interception Operations was an indicator of how they perceived simulation training as a substitute to underway training. Similarly, this was a MEF trainer and the focus of the trainer was MIO and Air Warfare. Since these were the critical mission areas trained, if that training in these areas met the needs of the trainee, the trainee believed that simulation has the possibility of replacing underway training.

Combine this observation with the previous analysis and the conclusion is twofold. Make sure that a trainer uses realistic simulations. Specifically, ensure they are realistic scenarios in the warfare areas the trainer is addressing. The training must be realistic at the console operator level to be effective. Then, and only then can distributed simulation be considered an effective replacement for underway training.

Regression Analysis: Ques22 (Multi-Ship Simulation, An Alternative to Underway Training**) versus Ques19 (**Simulation Provided Realistic Training at Watchstation**)**

```
The regression equation is
Ques22 = 0.432 + 0.631 Ques19

Predictor        Coef     SE Coef          T        P
Constant       0.4321      0.3330       1.30    0.210
Ques19         0.6311      0.1226       5.15    0.000

S = 0.7817      R-Sq = 58.3%     R-Sq(adj) = 56.1%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1      16.199      16.199     26.51    0.000
Residual Error    19      11.610       0.611
Total             20      27.810

Unusual Observations
Obs     Ques19     Ques22         Fit      SE Fit    Residual    St Resid
  4       6.00      6.000       4.219       0.481       1.781       2.89RX
  7       5.00      2.000       3.588       0.369      -1.588      -2.30R

      R denotes an observation with a large standardized residual
      X denotes an observation whose X value gives it large influence.
```

Durbin-Watson statistic = 2.17

MTB > If the simulation provided realistic training opportunities at the operators watch station then they think that combat systems training in a simulated environment can replace underway training. In other words, the Navy wants to use simulated training instead of underway training in some situations, the training system must provide realistic data on the operator's console. Operator training must be in real time, use the same consoles and strokes observed in an actual underway environment.

Regression Analysis: Ques22 (Multi-Ship Simulation, An Alternative to Underway Training**) versus Ques10 (**Understanding Ship's Duties in MEF**), Ques13 (**Confidence in Tracking, Intercepting and Reporting**), Ques11 (**Good Multi-Ship Operating Experience**)**

```
The regression equation is
Ques22 = 0.114 + 0.747 Ques10 + 0.257 Ques13 + 0.380 Ques11

Predictor        Coef     SE Coef          T        P
Constant     0.113966    0.006954      16.39    0.000
Ques10       0.747357    0.003629     205.95    0.000
Ques13       0.256611    0.002977      86.21    0.000
Ques11       0.380054    0.003644     104.29    0.000

S = 0.01645     R-Sq = 100.0%    R-Sq(adj) = 100.0%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         3     27.8049      9.2683  34243.74    0.000
Residual Error    17      0.0046      0.0003
Total             20     27.8095

Source       DF      Seq SS
Ques10        1     22.8600
Ques13        1      2.0011
Ques11        1      2.9438

Unusual Observations
Obs     Ques10     Ques22         Fit      SE Fit    Residual      St Resid
  4       6.00    6.00000     5.98127     0.01428     0.01873        2.29RX
  6       3.00    3.00000     3.04145     0.00874    -0.04145       -2.97R

R denotes an observation with a large standardized residual
X denotes an observation whose X value gives it large influence.
```

MTB > This indicates that there is a strong relationship between understanding MEF/Task Group operations, the ability to operate in a multi-ship environment, track contacts and report them to superiors. These are all positive indicators of how they perceive training in a simulated environment. Trainees believed that simulated training is a realistic alternative to underway training if they feel they learned about MEF operations and procedures, that the trainer provided a good experience in a multi-ship environment and that they learned to track contacts and report them.

Regression Analysis: Ques22 (Multi-Ship Simulation, An Alternative to Underway Training**) versus Ques6 (**Better Understanding of Air Contact Reporting**), Ques7 (**Better Understanding of When to Report Contacts**), Ques8 (**Better Understanding of Radio Reporting Procedures**), Ques9 (**Better Understanding of Contact Reporting Procedures**)**

```
The regression equation is
Ques22 = 0.774 - 0.059 Ques6 + 0.320 Ques7 + 0.258 Ques8 + 0.006 Ques9

Predictor        Coef     SE Coef          T        P
Constant       0.7740      0.3588       2.16    0.047
Ques6         -0.0589      0.1338      -0.44    0.665
Ques7          0.3204      0.4331       0.74    0.470
Ques8          0.2580      0.2908       0.89    0.388
Ques9          0.0063      0.3815       0.02    0.987

S = 0.8687      R-Sq = 56.6%     R-Sq(adj) = 45.7%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         4     15.7366      3.9342      5.21    0.007
Residual Error    16     12.0729      0.7546
Total             20     27.8095

Source       DF      Seq SS
Ques6         1      2.2907
Ques7         1     12.8400
Ques8         1      0.6058
Ques9         1      0.0002

Unusual Observations
Obs      Ques6     Ques22         Fit      SE Fit    Residual    St Resid
  4       6.00      6.000       3.929       0.550       2.071       3.08R
 21       6.00      2.000       3.929       0.550      -1.929      -2.87R
```

R denotes an observation with a large standardized residual

MTB > This indicates that communications is not a significant indicator of whether trainees think multi-ship exercises can substitute for live training. This is contrary to popular belief because it is thought better communications between task force members is one of the most important advantages of conducting this simulated training. Most groups believe simulated trainers provide an excellent opportunity to practice communication skills between ships. To the operators, it appears that understanding MIO operations, AAW and the realism of the scenario are the most important factors.

Regression Analysis: Ques22 (Multi-Ship Simulation, An Alternative to Underway Training**) versus Ques3 (**Practical OPTASK Experience**), Ques5 (**Know How to Apply OPTASKs**)**

```
The regression equation is
Ques22 = 0.174 + 0.473 Ques3 + 0.408 Ques5

Predictor        Coef     SE Coef         T        P
Constant       0.1738      0.2512      0.69    0.498
Ques3         0.47260     0.09957      4.75    0.000
Ques5          0.4077      0.1217      3.35    0.004

S = 0.5810      R-Sq = 78.2%     R-Sq(adj) = 75.7%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      21.734      10.867     32.20    0.000
Residual Error    18       6.075       0.338
Total             20      27.810

Source       DF      Seq SS
Ques3         1      17.951
Ques5         1       3.784

Unusual Observations
Obs      Ques3     Ques22         Fit      SE Fit    Residual    St Resid
  4       6.00      6.000       5.455       0.487       0.545        1.72 X

      X denotes an observation whose X value gives it large influence.
```

Durbin-Watson statistic = 1.28

MTB > This analysis confirms previous information about the importance of Maritime Interception Operations. The analysis indicates that if this trainer provided a better understanding of MIO reporting procedures and OPTASK application, the trainee believed this simulation is suitable replacement for underway training.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX P. REGRESSION DATA FROM THESIS SPECIFIC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER (USS RUSSEL AND USS FORD) ANALYSIS OF WHETHER RANK IS A FACTOR IN PERCEIVED USEFULNESS OF TRAINING

This appendix contains the regression data from the survey conducted on the USS RUSSEL and USS FORD following completion of the MEF Team Trainer that was simulated onboard the ship using TACDEW. This series of regression analyses describes whether rank was a determining factor in how individuals perceived the usefulness of the training.

Regression Analysis: Ques24 (Simulation Reduces Training Team Time**) versus Ques25 (**Rank**)**

```
The regression equation is
Ques24 = 2.54 - 0.283 Ques25

Predictor        Coef     SE Coef          T        P
Constant       2.5362      0.7650       3.32    0.004
Ques25        -0.2826      0.2843      -0.99    0.333

S = 1.031       R-Sq = 4.9%      R-Sq(adj) = 0.0%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1       1.050       1.050      0.99    0.333
Residual Error    19      20.188       1.063
Total             20      21.238

Unusual Observations
Obs     Ques25     Ques24         Fit      SE Fit    Residual    St Resid
  4       2.00      5.000       1.971       0.277       3.029       3.05R
 11       2.00      4.000       1.971       0.277       2.029       2.04R

R denotes an observation with a large standardized residual

Durbin-Watson statistic = 2.21
```

There seems to be no correlation between rank and the perceived savings of work time. The reduction in time is associated with the amount of time and effort required to prepare for an exercise.

Regression Analysis: Ques21 (Realistic Simulations Used) versus Ques25 (Rank)

```
The regression equation is
Ques21 = 3.26 - 0.435 Ques25

Predictor        Coef     SE Coef          T        P
Constant       3.2609      0.8356       3.90    0.001
Ques25        -0.4348      0.3106      -1.40    0.178

S = 1.126       R-Sq = 9.4%      R-Sq(adj) = 4.6%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1       2.484       2.484      1.96    0.178
Residual Error    19      24.087       1.268
Total             20      26.571

Unusual Observations
Obs     Ques25     Ques21         Fit      SE Fit    Residual    St Resid
  4       2.00      6.000       2.391       0.303       3.609       3.33R

       R denotes an observation with a large standardized residual

       Durbin-Watson statistic = 2.08
```

There does not appear to be a relation between rank and the perceived realism of the scenario. From E-1 to O-3 the perceived realism of the simulation was constant.

Regression Analysis: Ques20 (Simulation Provided Realistic Training at Watchstation) versus Ques25 (Rank)

```
The regression equation is
Ques20 = 3.53 - 0.576 Ques25

Predictor        Coef     SE Coef          T        P
Constant        3.529       1.085       3.25    0.004
Ques25        -0.5761      0.4032      -1.43    0.169

S = 1.462       R-Sq = 9.7%      R-Sq(adj) = 5.0%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1       4.362       4.362      2.04    0.169
Residual Error    19      40.591       2.136
Total             20      44.952

Unusual Observations
Obs     Ques25     Ques20         Fit      SE Fit    Residual    St Resid
  4       2.00      6.000       2.377       0.393       3.623       2.57R

       R denotes an observation with a large standardized residual

       Durbin-Watson statistic = 1.37
```

Rank does not seem to be a factor in how realism of the scenario and its contacts are perceived.

Regression Analysis: Ques25 (Rank**) versus Ques14 (**Better Understanding of MIO**), Ques15 (**Better Air Defense Understanding**)**

```
The regression equation is
Ques25 = 2.60 + 0.636 Ques14 - 0.699 Ques15

Predictor        Coef     SE Coef          T        P
Constant       2.6017      0.3275       7.94    0.000
Ques14         0.6356      0.2966       2.14    0.046
Ques15        -0.6992      0.3129      -2.23    0.038

S = 0.7541      R-Sq = 22.1%     R-Sq(adj) = 13.5%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      2.9056      1.4528      2.55    0.106
Residual Error    18     10.2373      0.5687
Total             20     13.1429

Source       DF      Seq SS
Ques14        1      0.0659
Ques15        1      2.8396

Unusual Observations
Obs     Ques14     Ques25         Fit      SE Fit    Residual    St Resid
  4       6.00      2.000       2.220       0.609      -0.220      -0.50 X
  8       2.00      4.000       2.475       0.170       1.525       2.08R
 16       2.00      4.000       2.475       0.170       1.525       2.08R

       R denotes an observation with a large standardized residual
       X denotes an observation whose X value gives it large influence.

       Durbin-Watson statistic = 1.26
```

MTB > This is somewhat tenuous, but the regression indicates that junior personnel received better training in the Mission area of Air Defense tactics, while more senior watchstanders received better training on MIO Operations. The negative relationship of air tactics to rank and the positive relationship between rank and MIO tactics indicate that this is the case..

Regression Analysis: Ques25 (Rank**) versus Ques13 (**Confidence in Tracking, Intercepting and Reporting**)**

```
The regression equation is
Ques25 = 3.14 - 0.286 Ques13

Predictor        Coef     SE Coef          T        P
Constant       3.1429      0.2703      11.63    0.000
Ques13        -0.2857      0.1103      -2.59    0.018

S = 0.7150      R-Sq = 26.1%     R-Sq(adj) = 22.2%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1      3.4286      3.4286      6.71    0.018
Residual Error    19      9.7143      0.5113
Total             20     13.1429

Unusual Observations
Obs     Ques13     Ques25         Fit      SE Fit    Residual    St Resid
  4       6.00      2.000       1.429       0.468       0.571        1.06
X

X denotes an observation whose X value gives it large influence.

Durbin-Watson statistic = 1.10
```

MTB > Again, this is somewhat tenuous but the p value is fairly good. This may indicate that the junior personnel seemed to be more confident in their ability to track, coordinate, report and intercept contacts in conjunction with other ships. This is logical since junior personnel generally man the consoles. The data indicates that operators received quality tracking training through the use of simulation. The simulation training used provided realistic tracking experience at the operator level.

APPENDIX Q. REGRESSION DATA FROM THESIS SPECIFIC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER (USS RUSSEL AND USS FORD) TRAINING TEAM MEMBERSHIP A FACTOR IN VALUE OF TRAINING

This appendix contains the regression data from the survey conducted on the USS RUSSEL and USS FORD following completion of the MEF Team Trainer that was simulated onboard the ship using TACDEW. This series of regressions is an analysis of whether people on the combat systems training team viewed the value of training differently than people who were not on the combat systems training team.

Regression Analysis: Ques26 (On My Ship's Combat Systems Training Team**) versus Ques24 (**Simulation Reduces Training Team Time**), Ques22 (**Multi-ship Simulation, An Alternative to Underway Training?**)**

```
The regression equation is
Ques26 = 1.36 + 0.257 Ques24 - 0.233 Ques22

Predictor        Coef     SE Coef         T        P
Constant       1.3594      0.2155      6.31    0.000
Ques24         0.2574      0.1127      2.28    0.035
Ques22       -0.23325     0.09850     -2.37    0.029

S = 0.4439      R-Sq = 28.4%     R-Sq(adj) = 20.4%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      1.4050      0.7025      3.56    0.050
Residual Error    18      3.5474      0.1971
Total             20      4.9524

Source       DF      Seq SS
Ques24        1      0.2999
Ques22        1      1.1051

Unusual Observations
Obs     Ques24     Ques26         Fit      SE Fit    Residual    St Resid
  4       5.00     1.0000      1.2470      0.3883     -0.2470       -1.15 X
 11       4.00     2.0000      2.1559      0.3180     -0.1559       -0.50 X

X denotes an observation whose X value gives it large influence.

Durbin-Watson statistic = 2.23
```

MTB > This analysis is an interesting indicator. The overall equation is not very good but the p values for questions 22 and 24 seem to be significant. Interestingly, it appears that there is a negative correlation between being a Combat Systems Training Team (CSTT) member and the belief that combat simulations a suitable replacement to underway training. Since 1 is the low for being on CSTT, this indicates that people on the CSTT are more likely to think that training can be accomplished in a simulated environment versus underway. It also means that the operators are less likely to believe that simulation can be used instead of underway training when compared to CSTT members. This regression also addresses time savings from conducting simulated training. Since the time reduction for doing a training scenario is positively coordinated it indicates that more time is saved at the trainee level than at the coordination level by the training team members.

Regression Analysis: Ques26 (On My Ship's Combat Systems Training Team**) versus Ques10 (**Understanding Ship's Duties in MEF**), Ques12 (**More Confidence in Ship's Ability**)**

```
The regression equation is
Ques26 = 1.45 - 0.230 Ques10 + 0.182 Ques12

Predictor        Coef     SE Coef          T        P
Constant       1.4461      0.2017       7.17    0.000
Ques10        -0.2303      0.1324      -1.74    0.099
Ques12         0.1822      0.1302       1.40    0.179

S = 0.4849      R-Sq = 14.6%     R-Sq(adj) = 5.1%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      0.7206      0.3603      1.53    0.243
Residual Error    18      4.2318      0.2351
Total             20      4.9524

Source       DF      Seq SS
Ques10        1      0.2605
Ques12        1      0.4601

Unusual Observations
Obs     Ques10     Ques26         Fit      SE Fit    Residual    St Resid
  4       6.00      1.000       1.157       0.426      -0.157       -0.68 X
  7       1.00      2.000       1.945       0.375       0.055        0.18 X

       X denotes an observation whose X value gives it large influence.
```

MTB >This analysis gives a slight indication that CSTT members believed they learned more about the ships duties in the MEF or task group because of the negative coefficient of in the regression equation.

Regression Analysis: Ques26 (On My Ship's Combat Systems Training Team) versus **Ques6** (Understanding Air Contact Reporting)

```
The regression equation is
Ques26 = 1.27 + 0.0436 Ques6

Predictor        Coef     SE Coef          T        P
Constant       1.2731      0.1824       6.98    0.000
Ques6         0.04356     0.05881       0.74    0.468

S = 0.5033      R-Sq = 2.8%      R-Sq(adj) = 0.0%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1      0.1390      0.1390      0.55    0.468
Residual Error    19      4.8134      0.2533
Total             20      4.9524
```

MTB > Once again perceptions of communication training are equally distributed between CSTT members and CSTT non-members.

APPENDIX R. REGRESSION DATA FROM THESIS SPECIFIC SURVEY FOLLOWING DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER (USS RUSSEL AND USS FORD) REASONS WHY THE TRAINER DID OR DID NOT MEET EXPECTATIONS

This appendix contains the regression data from the survey conducted on the USS RUSSEL and USS FORD following completion of the MEF Team Trainer simulated onboard using TACDEW. This series of regression data is an analysis of the reasons why the trainer did or did not meet expectations.

Regression Analysis: Quess23 (Trainer Met Expectations**) versus Ques18 (**More Confidence in Watchstation Duties**), Ques19 (**Simulation Provided Realistic Training at Watchstation**), Ques21 (**Realistic Simulations Used**)**

```
The regression equation is
Quess23 = - 0.401 + 0.507 Ques18 + 0.436 Ques19 + 0.439 Ques21

Predictor         Coef     SE Coef          T        P
Constant       -0.4008      0.4943      -0.81    0.429
Ques18          0.5068      0.1925       2.63    0.017
Ques19          0.4363      0.2056       2.12    0.049
Ques21          0.4392      0.2315       1.90    0.075

S = 0.8487      R-Sq = 74.1%     R-Sq(adj) = 69.5%

Analysis of Variance

Source            DF          SS          MS         F         P
Regression         3      34.992      11.664     16.19     0.000
Residual Error    17      12.246       0.720
Total             20      47.238

Source       DF      Seq SS
Ques18        1      15.572
Ques19        1      16.827
Ques21        1       2.593

Unusual Observations
Obs     Ques18    Ques23         Fit      SE Fit    Residual    St Resid
  4       1.00     6.000       5.359       0.726       0.641        1.46 X
  6       4.00     5.000       3.378       0.468       1.622        2.29R
 13       2.00     1.000       2.803       0.318      -1.803       -2.29R

      R denotes an observation with a large standardized residual
      X denotes an observation whose X value gives it large influence.
```

MTB > The leading causes of a trainer (TACDEW/BFTT) meeting the operator's expectations is whether they could perform their watch station duties better as a result of the trainer and whether the scenarios provided realistic training opportunities at their watch station. These three areas appear to be indicators of whether a trainer met or exceeded expectations. The development of simulation training should, in part, focus on the realism of the trainer at the operator level.

Regression Analysis: Quess23 (Trainer Met Expectations**) versus Ques14 (**Better Understanding of MIO**)**

```
The regression equation is
Quess23 = 0.640 + 0.920 Ques14

Predictor        Coef     SE Coef          T        P
Constant       0.6400      0.4503       1.42    0.171
Ques14         0.9200      0.1891       4.86    0.000

S = 1.052       R-Sq = 55.5%     R-Sq(adj) = 53.1%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1      26.198      26.198     23.66    0.000
Residual Error    19      21.040       1.107
Total             20      47.238

Unusual Observations
Obs     Ques14    Quess23         Fit      SE Fit    Residual    St Resid
  4       6.00      6.000       6.160       0.782      -0.160       -0.23
X
  7       1.00      4.000       1.560       0.303       2.440       2.42R
 10       2.00      5.000       2.480       0.230       2.520       2.45R

R denotes an observation with a large standardized residual
X denotes an observation whose X value gives it large influence.
```

MTB > This indicates that the trainer met or exceeded expectations and if the trainee felt it developed a better understanding of Maritime Interception Operations. This should be expected since the primary goal of this trainer was to emphasize MIO operations. The results indicate that the scenarios should be challenging and thorough in the mission area to be trained if they are to be effective.

Regression Analysis: Quess23 (Trainer Met Expectations**) versus Ques10 (**Understanding Ship's Duties in MEF**), Ques13 (**Confidence in Tracking, Intercepting and Reporting**)**

```
The regression equation is
Quess23 = 0.512 + 0.625 Ques10 + 0.470 Ques13

Predictor        Coef     SE Coef          T        P
Constant       0.5119      0.4024       1.27    0.220
Ques10         0.6250      0.2099       2.98    0.008
Ques13         0.4702      0.1723       2.73    0.014

S = 0.9522      R-Sq = 65.4%     R-Sq(adj) = 61.6%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      30.917      15.458     17.05    0.000
Residual Error    18      16.321       0.907
Total             20      47.238

Source       DF       Seq SS
Ques10        1       24.162
Ques13        1        6.754
```

```
Unusual Observations
Obs     Ques10    Quess23         Fit      SE Fit    Residual    St Resid
  4       6.00      6.000       7.083       0.825      -1.083      -2.28RX
  6       3.00      5.000       2.857       0.441       2.143       2.54R

       R denotes an observation with a large standardized residual
       X denotes an observation whose X value gives it large influence.
```

MTB > Once again there is a strong relationship between whether the trainee received a good understanding of ship's duties in the MEF or task group and they improved their ability to track and report contacts versus their satisfaction with the trainer. This indicates that if the trainee receives a practical mission area experience, the trainer will meet trainee expectations.

Regression Analysis: Quess23 (Trainer Met Expectations**) versus Ques7 (**Better Understanding of When to Report Contacts**), Ques6 (**Better Understanding of Air Contact Reporting**)**

```
The regression equation is
Quess23 = 1.06 + 0.898 Ques7 - 0.184 Ques6

Predictor        Coef     SE Coef          T        P
Constant       1.0551      0.3633       2.90    0.009
Ques7          0.8984      0.1505       5.97    0.000
Ques6         -0.1843      0.1251      -1.47    0.158

S = 0.9044      R-Sq = 68.8%     R-Sq(adj) = 65.4%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      32.516      16.258     19.88    0.000
Residual Error    18      14.722       0.818
Total             20      47.238

Source       DF      Seq SS
Ques7         1      30.741
Ques6         1       1.776
```

MTB > This indicates that the scenario met trainee expectations and if it taught the operator when to report contacts to their operational commanders. The trainee did not seem to relate the knowledge of who to report to as much as when to report contacts. In fact there is a negative relationship between who the trainee reports to and the realism of the trainer.

Regression Analysis: Quess23 (Trainer Met Expectations**) versus Ques3 (**Practical OPTASK Experience**), Ques5 (**Know how to Apply OPTASKs**), Ques1 (**Warfare Commander Understanding**), Ques4 (**Better LINK Understanding**)**

```
The regression equation is
Quess23 = 0.268 + 0.797 Ques3 + 0.454 Ques5 - 0.387 Ques1 + 0.198 Ques4

Predictor        Coef     SE Coef          T        P
Constant       0.2677      0.3861       0.69    0.498
Ques3          0.7972      0.1833       4.35    0.000
Ques5          0.4540      0.1664       2.73    0.015
Ques1         -0.3875      0.1538      -2.52    0.023
Ques4          0.1984      0.1112       1.78    0.093

S = 0.7893      R-Sq = 78.9%     R-Sq(adj) = 73.6%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         4     37.2696      9.3174     14.95    0.000
Residual Error    16      9.9685      0.6230
Total             20     47.2381

Source       DF      Seq SS
Ques3         1     28.1612
Ques5         1      4.8776
Ques1         1      2.2484
Ques4         1      1.9824

Unusual Observations
Obs      Ques3    Quess23         Fit      SE Fit    Residual    St Resid
  2       2.00      1.000       2.581       0.284      -1.581      -2.15R
  4       6.00      6.000       6.641       0.668      -0.641      -1.52 X
 20       1.00      1.000       2.322       0.479      -1.322      -2.11R
```

R denotes an observation with a large standardized residual
X denotes an observation whose X value gives it large influence.

MTB > This indicates that the realism of the training experience is dependent on the ability of the scenario to provide the operator with practice using the OPTASKS. This is especially true of the MEF OPTASKS because this was the focus of the training event. The ability to learn what warfare commander to report to was also critical to the realism of the exercise. This indicates that creating a realistic command and control environment is an important part of the entire simulated experience. Training commands should continue to stress the reporting criteria in their exercises.

APPENDIX S. FCTCPAC SURVEY FOLLOWING MIDDLE EAST FORCE TEAM TRAINER CONDUCTED IN FCTCPAC MOCKUP (CDS-23 AND USS OLDENDORF) REASONS MOCKUP USABLE & WHY SCENARIOS ARE REALISTIC

This appendix contains the regression data from the survey conducted on the USS OLDENDORF and CDS-23 following completion of the MEF Team Trainer that was conducted, using TACDEW, in the flag control center and CIC mockups located at FCTCPAC. The analysis examines two questions. First, what factors influence a sailor's view that a mockup is usable? Second, what factors influence whether a scenario was realistic.

Regression Analysis: Ques8 (Mockup usable) **versus Ques6** (Equipment Safe), **Ques13** (Equipment in Good Condition)

```
The regression equation is
Mockup usable = 1.39 + 0.583(Equipment Safe) + 0.0358(Equip in Good Condition)

Predictor                     Coef     SE Coef          T        P
Constant                    1.3925      0.3514       3.96    0.002
Equipment Safe              0.5826      0.1438       4.05    0.002
Equip. in Good Condition    0.03583     0.09897      0.36    0.724

S = 0.2658      R-Sq = 75.8%     R-Sq(adj) = 71.4%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      2.4370      1.2185     17.24    0.000
Residual Error    11      0.7773      0.0707
Total             13      3.2143

Source                     DF      Seq SS
Equipment Safe              1      2.4278
Equip. in Good Condition    1      0.0093


       Durbin-Watson statistic = 2.21
```

MTB > Mockup usable is well predicted by equipment in good condition and the equipment safe. The major factor that determines whether a mockup is usable is the safety of the equipment. This indicates that sailors can train with equipment in questionable condition as long as it is safe.

Regression Analysis: Ques8 (Mockup Usable) **versus Ques6** (Equipment Safe)

```
The regression equation is
Mockup usable = 1.37 + 0.618(Equipment Safe)

Predictor             Coef     SE Coef         T        P
Constant            1.3708      0.3335      4.11    0.001
Equipment Safe      0.6180      0.1015      6.09    0.000

S = 0.2560      R-Sq = 75.5%     R-Sq(adj) = 73.5%

Analysis of Variance

Source           DF          SS          MS         F        P
Regression        1      2.4278      2.4278     37.04    0.000
Residual Error   12      0.7865      0.0655
Total            13      3.2143


      Durbin-Watson statistic = 2.13
```

MTB > This means that equipment safe and equipment useable are the dependent factors. If it is safe then sailors can use it.

Regression Analysis: **Ques9** (Scenario Appropriate) **versus Ques12** (Training at Appropriate Level), **Ques8** (Mockup Usable)

```
      The regression equation is
Scenario Appropriate = - 1.68 + 0.332(Appropriate level) + 1.10(Mockup usable)

Predictor                Coef     SE Coef          T        P
Constant              -1.6818      0.7046      -2.39    0.036
Appropriate level      0.3322      0.1475       2.25    0.046
Mockup usable          1.1049      0.2564       4.31    0.001

S = 0.3718      R-Sq = 83.0%     R-Sq(adj) = 79.9%

Analysis of Variance

Source           DF          SS          MS         F        P
Regression        2      7.4076      3.7038     26.79    0.000
Residual Error   11      1.5210      0.1383
Total            13      8.9286

Source                   DF      Seq SS
Appropriate Level        1      4.8403
Mockup usable            1      2.5673


      Durbin-Watson statistic = 2.35
```

MTB > It appears that people think that the atmosphere of the mockup and appropriate level of training are indicators of the scenario being appropriate. Trainees want to learn in a comfortable, realistic mockup and they want the training to be challenging and at the appropriate level.

Regression Analysis: Ques11 (Training Realistic and Challenging) **versus Ques13** (Equipment in Good Condition)

```
      The regression equation is
Training realistic and challenging = 1.47 + 0.596(Equipment in Good Condition)

Predictor                     Coef     SE Coef         T        P
Constant                    1.4681      0.3898      3.77    0.003
Equip in Good Condition     0.5957      0.1417      4.21    0.001

S = 0.5191      R-Sq = 59.6%     R-Sq(adj) = 56.2%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1      4.7660      4.7660     17.68    0.001
Residual Error    12      3.2340      0.2695
Total             13      8.0000

Unusual Observations
Obs   Equip in   scenario         Fit      SE Fit    Residual    St Resid
 11       1.00      3.000       2.064       0.262       0.936       2.09R
 14       1.00      1.000       2.064       0.262      -1.064      -2.37R

      R denotes an observation with a large standardized residual

      Durbin-Watson statistic = 0.80
```

MTB > Equipment in good condition is a good indicator of the scenario being realistic/ challenging but they are highly correlated.

Regression Analysis: Ques11 (Training Realistic and Challenging) **versus Ques13** (Equipment in Good Condition), **Ques12** (Appropriate Level).

```
      The regression equation is
Training realistic and challenging = 0.477 + 0.382(Equip in Good Condition)
           + 0.490(Appropriate Level)

Predictor                     Coef     SE Coef         T        P
Constant                    0.4770      0.3950      1.21    0.253
Equip in Good Condition     0.3819      0.1179      3.24    0.008
Appropriate Level           0.4903      0.1386      3.54    0.005

S = 0.3708      R-Sq = 81.1%     R-Sq(adj) = 77.7%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      6.4874      3.2437     23.59    0.000
Residual Error    11      1.5126      0.1375
Total             13      8.0000

Source                          DF      Seq SS
Equip in Good Condition          1      4.7660
Appropriate Level                1      1.7214

Unusual Observations
Obs   Equip in   scenario         Fit      SE Fit    Residual     St Resid
```

7	2.00	2.0000	2.7117	0.1157	-0.7117	-2.02R
11	1.00	3.0000	2.3299	0.2019	0.6701	2.15R

R denotes an observation with a large standardized residual

Durbin-Watson statistic = 1.84

MTB > This is a very good equation which indicates that the realism of the scenario is highly dependent on the equipment being in good condition and the training being held at the appropriate level.

Regression Analysis: Ques8 (Mockup usable) **versus Ques6** (Equipment Safe), **Ques13** (Equipment in Good Condition)

The regression equation is
Mockup Usable = 1.39 + 0.583(Equipment Safe) + 0.0358(Equip in Good Condition)

Predictor	Coef	SE Coef	T	P
Constant	1.3925	0.3514	3.96	0.002
Equipment Safe	0.5826	0.1438	4.05	0.002
Equip in Good Condition	0.03583	0.09897	0.36	0.724

S = 0.2658 R-Sq = 75.8% R-Sq(adj) = 71.4%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	2.4370	1.2185	17.24	0.000
Residual Error	11	0.7773	0.0707		
Total	13	3.2143			

Source	DF	Seq SS
Equipment Safe	1	2.4278
Equip in Good Condition	1	0.0093

Durbin-Watson statistic = 2.21

MTB > The biggest factor in determining if a mockup is usable is the safety of the equipment.

APPENDIX T. DISTRIBUTED MIDDLE EAST FORCE TEAM TRAINER (USS MILLIUS AND USS OLDENDORF) FACTORS INFLUENCING REALISM OF SCENARIOS

This appendix contains the regression data from the survey conducted on the USS OLDENDORF and USS MILLIUS following completion of the MEF Team Trainer that was distributed, using TACDEW and BFTT, to the ships in San Diego. This analysis provides data about what factors influence a sailor's perception that a scenario is realistic.

Regression Analysis: Ques1 (Scenarios Realistic Used**) versus Ship #, Rank**

```
      The regression equation is
Scenarios Realistic = 0.847 + 0.911(Ship #) + 0.198(Rank)

Predictor        Coef     SE Coef          T        P
Constant       0.8472      0.6964       1.22    0.233
Ship #         0.9110      0.3705       2.46    0.020
Rank           0.1982      0.2279       0.87    0.391

S = 0.9677      R-Sq = 24.2%     R-Sq(adj) = 19.5%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      9.5797      4.7899      5.12    0.012
Residual Error    32     29.9632      0.9363
Total             34     39.5429

Source       DF       Seq SS
Ship #        1       8.8715
Rank          1       0.7082

Unusual Observations
Obs       Ship   Scenario         Fit      SE Fit    Residual    St Resid
  7       1.00      0.000       2.155       0.282      -2.155      -2.33R
 15       1.00      0.000       2.353       0.303      -2.353      -2.56R
 22       2.00      1.000       3.264       0.207      -2.264      -2.39R

      R denotes an observation with a large standardized residual

      Durbin-Watson statistic = 1.40
```

MTB > There does not appear to be any relation between rank, ship and thinking that the scenario is realistic.

Regression Analysis: Ques3 (Scenarios Meet Training Need) versus Ship #

```
The regression equation is
Training Needed = 1.57 + 0.738(Ship#1 or Ship #2)

Predictor        Coef     SE Coef          T        P
Constant       1.5699      0.5247       2.99    0.005
Ship #           0.7378      0.3089       2.39    0.023

S = 0.8829      R-Sq = 14.7%     R-Sq(adj) = 12.2%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1      4.4477      4.4477      5.71    0.023
Residual Error    33     25.7238      0.7795
Total             34     30.1714

Unusual Observations
Obs       Ship   Training         Fit      SE Fit    Residual    St Resid
 27       2.00      1.000       3.045       0.188      -2.045       -2.37R

R denotes an observation with a large standardized residual

Durbin-Watson statistic = 1.82
```

MTB > There does not appear to be a good relation between ship and training needed.

Regression Analysis: Ques1 (Scenarios Realistic**) versus Ques2 (**Volume of Tracks Realistic and Challenging**)**

```
      The regression equation is
Scenarios Realistic = 1.08 + 0.688(Volume of Tracks Realistic and Challenging)

Predictor        Coef     SE Coef          T        P
Constant       1.0769      0.4042       2.66    0.012
Good Volume    0.6881      0.1439       4.78    0.000

S = 0.8414      R-Sq = 40.9%     R-Sq(adj) = 39.1%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         1      16.181      16.181     22.86    0.000
Residual Error    33      23.362       0.708
Total             34      39.543

Unusual Observations
Obs   Good Vol   Scenario         Fit      SE Fit    Residual    St Resid
  7       1.00      0.000       1.765       0.274      -1.765      -2.22R
 15       1.00      0.000       1.765       0.274      -1.765      -2.22R
 28       1.00      4.000       1.765       0.274       2.235       2.81R

R denotes an observation with a large standardized residual

Durbin-Watson statistic = 1.40
```

MTB > A good volume of tracks is an indicator of scenarios realistic.

Regression Analysis: Ques1 (Scenarios Realistic**) versus Ques2 (**Volume of Tracks Realistic and Challenging**), Ques5 (**Disclosure Timely**)**

```
      The regression equation is
Scenarios Realistic = 0.675 + 0.444(Volume of Tracks Realistic and Challenging)
+ 0.373(Disclosure Timely)

Predictor          Coef      SE Coef       T        P
Constant          0.6752      0.4046       1.67    0.105
Good Volume       0.4436      0.1633       2.72    0.011
Disclosure Timely 0.3730      0.1446       2.58    0.015

S = 0.7774      R-Sq = 51.1%     R-Sq(adj) = 48.0%

Analysis of Variance

Source            DF          SS          MS         F        P
Regression         2      20.204      10.102     16.72    0.000
Residual Error    32      19.339       0.604
Total             34      39.543

Source            DF      Seq SS
Good Volume        1      16.181
Disclosure Timely  1       4.023

Unusual Observations
Obs   Good Vol   Scenario         Fit      SE Fit    Residual    St Resid
  5       3.00      3.000       2.006       0.462       0.994        1.59 X
 15       1.00      0.000       1.492       0.275      -1.492       -2.05R
 28       1.00      4.000       2.238       0.313       1.762        2.48R

      R denotes an observation with a large standardized residual
      X denotes an observation whose X value gives it large influence.

      Durbin-Watson statistic = 1.60
```

MTB > It appears that this is a very good indicator. The P values are very good and there seems to be little autocorrelation. Timely disclosures and good volume of tracks are leading indicators of whether scenarios are realistic.

Regression Analysis: Ques1 (Scenarios Realistic**) versus Ques2 (**Volume of Tracks Realistic and Challenging**), Ques5 (**Disclosure Timely**), Ques4 (**Disclosure Adequate**)**

```
      The regression equation is
Scenarios Realistic = 0.368 + 0.420(Volume of Tracks Realistic and Challenging)
+ 0.198(Disclosure Timely) + 0.307(Disclosure Adequate)

Predictor                Coef     SE Coef          T        P
Constant               0.3684      0.4608       0.80    0.430
Good Volume            0.4202      0.1623       2.59    0.015
Disclosure Timely      0.1980      0.1936       1.02    0.314
Disclosure Adequate    0.3066      0.2291       1.34    0.190

S = 0.7679      R-Sq = 53.8%     R-Sq(adj) = 49.3%

Analysis of Variance

Source            DF          SS          MS         F        P
```

Regression	3	21.2609	7.0870	12.02	0.000
Residual Error	31	18.2820	0.5897		
Total	34	39.5429			

Source	DF	Seq SS
Good Volume	1	16.1808
Disclosure Timely	1	4.0232
Disclosure Adequate	1	1.0568

Unusual Observations

Obs	Good Vol.	Scenario	Fit	SE Fit	Residual	St Resid
5	3.00	3.000	2.242	0.489	0.758	1.28 X
28	1.00	4.000	2.302	0.313	1.698	2.42R

R denotes an observation with a large standardized residual
X denotes an observation whose X value gives it large influence.

Durbin-Watson statistic = 1.64

MTB > Overall volume tracks, helpful and timely are better predictors but the P value of each individual indicator is less. The best indicator appears to be volume of tracks and the quality of disclosures. Rank and ship type are weak indicators of whether a scenario is realistic.

Regression Analysis: Ques1 (Scenarios Realistic**) versus Ques2 (**Volume of Tracks Realistic and Challenging**), Ques5 (**Disclosure Timely**)**

The regression equation is
Scenarios Realistic **= 1.68 + 0.411**(Volume of Tracks Realistic and Challenging) **+ 0.231** (Disclosure Timely) **- 1.20(**one divided by Ques3, Scenarios meet training need)

Predictor	Coef	SE Coef	T	P
Constant	1.6814	0.6853	2.45	0.020
Good Volume	0.4111	0.1590	2.59	0.015
Disclosure Timely	0.2307	0.1609	1.43	0.162
1/Ques3	-1.1987	0.6702	-1.79	0.083

S = 0.7520 R-Sq = 55.7% R-Sq(adj) = 51.4%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	22.0132	7.3377	12.98	0.000
Residual Error	31	17.5297	0.5655		
Total	34	39.5429			

Source	DF	Seq SS
Good Volume	1	16.1808
Disclosure Timely	1	4.0232
1/Ques3	1	1.8092

Unusual Observations

Obs	Good Vol	Scenario	Fit	SE Fit	Residual	St Resid
5	3.00	3.000	2.615	0.562	0.385	0.77 X
22	1.00	1.000	2.385	0.313	-1.385	-2.03R
27	3.00	4.000	2.408	0.423	1.592	2.56R
28	1.00	4.000	2.485	0.332	1.515	2.25R

R denotes an observation with a large standardized residual
X denotes an observation whose X value gives it large influence.

```
Durbin-Watson statistic = 1.57
```

MTB > 1/ training may be a better indicator. Appears to indicate that there is an opposite relation between the need for the trainer and the person's perception about how realistic the scenarios are. The data indicates that people that wanted the training were the most likely to be disappointed by the trainer. People with high expectations may be more easily disappointed.

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

1. Belcher, Steven W., Methodology For Analyzing the Costs and Benefits of Video Teletraining (VTT), p.1, Center for Naval Analyses, 1997.

2. Jones, G.E., Applied Operations Research, p.9, John Wiley & Sons, Inc. 1976.

3. Seaman, Keith A., Improving F-15C Air Combat Training with Distributed Mission Training Advanced Simulation, Master's Thesis, p.1, Maxwell Air Force Base, 1000.

4. Francis, Peter J., OPTEMPO and Readiness, p.5, Center for Naval Analyses, 1999.

5. Commanders In Chief United States Pacific Fleet and Atlantic Fleet, Pacific Fleet and Atlantic Fleet Training Strategy, Enclosure 1, p. 1, 2001.

6. Browne, Herbert A. VADM, Statement to the Readiness Subcommittee of the Senate Armed Services Committee, p. 1, 17 April 1997.

7. Commander Harry S. Truman Battle Group, In port Battle Group Training, MSG, 101930Z FEB 00.

8. Commanders Naval Surface Forces Atlantic and Pacific, Surface Force Training Manual, p. 5-1-2, 1999.

9. Commanders Naval Surface Forces Atlantic and Pacific, Surface Force Training Manual, p. I-1-2, 1999.

10. Bergenthal, Jeffery J., Clark, Douglas, Maassel, Paul W., Root, Carrie Karangelen, Development of a Naval Training Federation, p.2, 1999.

11. Air Force Research Laboratory, Distributed Mission Training Technology and Methods, www.williams.af.mil/html/dmtdev.htm. 10 October, 2001.

12. Telephone Conversation between Gary Wentz an, N75 CNCPACFLT, and author, 16 October, 2001.

13. Seaman, Keith A., Improving F-15C Air Combat Training with Distributed Mission Training Advanced Simulation, Master's Thesis, p.18, Maxwell Air Force Base, 1000.

14. Interview with Capt Phil Lenfant, Director of Fleet Training, U.S. Pacific Fleet, 10 July, 2001, U.S. Pacific Fleet Online, www.cpf.navy.mil/news/1on1/990927lenfant.html.

15. Commanders Naval Surface Forces Atlantic and Pacific, Surface Force Training Manual, p. I-1-2, 1999.

16. PMS-430, CM PLAN NO: PMS-430-CMP-99-1, Configuration Management Plan for the Naval Performance Monitoring, Training Assessment Program Office (PMS 430), pp. 1-1 –1-10, 19 March 1999.

17. Naval Submarine Training Center, Pacific, Navy Surface Trainers, www.nstc.navy.mil/programs/trainers/surface/surtrnr/tacdew.htm, 9 October, 2001.

18. Afloat Training Group Atlantic, Welcome to ISAT Homepage, www.atgl.spear.navy.mil/ftp/isat/tcd, 22 October, 2001.

19. Naval Submarine Training Center, Pacific, Tactics and Training, www.cnet.navy.mil/nstcp/tactics2.htm. 22 October 2001.

20. Naval Air Warfare Center Training Systems Division, Function of Submarine Combat Systems Trainers, www.nstc.navy.mil/Programs/Trainers/Undersea/Subtrnr/cst.htm?men=TRD, 22 October 2001.

21. Naval Air Warfare Center, Training Systems Division, West Coast COMS Contract, N61339-98-C-0070, September 17, 1998, pp. A-4-G-5.

22. Military composite standard pay index.

23. Hedge, Tom, PMS 430 Budget Excerpts, letter, September 21, 2001.

24. Interview with Electronics Technician Chief Garofalo, Fleet Combat Training Center Pacific, September 27, 2001.

25. Watchbills, Operations Specialist Chief Palmer, September 27, 2001.

26. Interview with ETC Garofalo, Fleet Combat Training Center Pacific, September 27, 2001.

27. Phone conversation, Rose, Greg, West Coast BFTT Port Engineer, October 9, 2001.

28. Letter, BFTT Installation Excel Document, Rose, Greg, West Coast BFTT Port Engineer, October 8, 2001.

29. Power Point Presentation, Commander in Chief, Pacific Fleet, Range Operation Cost, E-mail, Taylor, Randy, October 26, 2001.

30. Belcher, Steven W., Methodology For Analyzing the Costs and Benefits of Video Teletraining (VTT), p. 44, Center for Naval Analyses, 1997.

31. Chief of Naval Operations, Administrative Message, 031208Z OCT 00.

32. Commander Cruiser Destroyer Group One, Administrative Message, 111932Z OCT 00, p 3.

33. Commanding Officer USS The Sullivans, Administrative Message, 161000Z Nov 00.

34. Liewer, Steve, Shortage of Cash for Fuel Leaves Navy Ships Parked at Pier, August 28, 2000, Stars and Stripes, www.pstripes.com/ed082800a.html.

35. Liewer, Steve, Shortage of Funds for Fuel is Again a Factor as Many Ships Remain In Port, March 28, 2001, Stars and Stripes, ww2.pstripes.osd.mil/01/mar01/ed032801k.html.

36. Commander Cruiser Destroyer Group One, Administrative Message, 111932Z OCT 00, p. 1.

37. Quadrennial Defense Review Report, Chairman of the Joint Chiefs of Staff, Shelton, Henry H., Department of Defense, p. 47, September30, 2001.

THIS PAGE INTENTIONALLY LEFT BLANK

BIBLIOGRAPHY

1. Render, Barry and Stair, Ralph M., Quantitative Analysis for Management, 7th ed., Prentice Hall, 2000.

2. Stickney, C.P. and Weil, R. L., Financial Accounting, An Introduction to Concepts, Methods and Uses, 9th ed., The Dryden Press, 2000.

3. Horngren, Charles T. and Harrison, Walter T., Accounting, 2nd ed., Prentice hall, 1992.

4. Department of the Navy, Highlights of the Department of the navy FY 2002 Budget, June, 2001.

5. Brigham E. F., Gapenski, L.C., and Ehrhardt, M.C., Financial Management Theory and Practice, 9th ed., Harcourt College Publishers 1999.

4. Crawford, Alice and Dougherty, Julie, Analysis and Redesign of the Navy Retention/Separation Questionnaire, Chief of Naval Personnel, 1995.

5. Slant, Priscilla A. and Dillman, Don A., How to Conduct Your Own Survey, John Wiley and Sons, Inc., 1994.

6. Congressional Budget Office, ISBN 0-16-050520-8, Budgeting for Defense: Maintaining Today's Forces, September, 2000.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, VA

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, CA

3. LCDR Scott Montgomery
   Fleet Combat Training Center Pacific
   San Diego, CA

4. Mr. Gary Wentz
   U.S. Pacific Fleet
   Pearl Harbor, HI

5. Commander Bill Hatch
   Naval Postgraduate School Code GSBPP/Hh
   555 Dyer Rd, Rm 236
   Monterey, CA 93943

6. VADM Sennis McGinn
   Deputy Chief of Naval Operations
   (Warfare Requirements and Programs)